INDIA RUBBER WORLD

ECHNOLOGY DEPARTMENT

OUR 60th YEAR

PUBLIC L[illegible]
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A BILL BROTHERS PUBLICATION

MAY, 1949

Spheron

Spheron 9 is one of the carbon blacks developed more than ten years ago by Cabot for the rubber industry. This channel black with its invariable easy processing properties is one of many that have made the name Cabot synonymous with uniform quality carbon blacks.

9 EPC*

CABOT GODFREY L. CABOT, INC., Boston 10, Mass.

* EASY PROCESSING CHANNEL

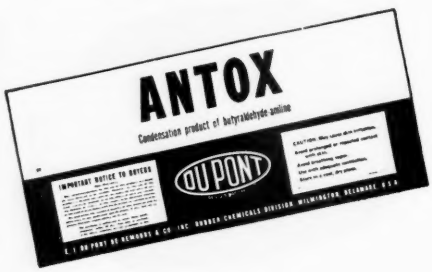
Use the Du Pont Antioxidant that Fits Your Needs

	FOR PROTECTION AGAINST		
	NORMAL AGING	HEAT AGING	FLEX FAILURE
1 NEOZONE A	Excellent	Good	Good
2 AKROFLEX C	Excellent	Excellent	Very Good
3 THERMOFLEX A	Excellent	Excellent	Excellent
4 ANTOX	Very Good	Very Good	No Effect

NEOZONE A—As a general-purpose antioxidant, Neozone A is outstanding in effectiveness and economy. It provides excellent protection against normal aging and improves the heat-aging and flex-cracking resistance of both natural and synthetic rubber stocks. Equal antioxidant protection may be obtained using Neozone D. However, Neozone A is much more soluble in elastomers, hence is preferable.

AKROFLEX C—Second only to Thermoflex A for protecting stocks against all three types of deterioration. Gives protection equal to Thermoflex A against normal aging and heat, but is slightly less effective against fatigue failures.

THERMOFLEX A—For applications requiring *maximum protection against all three types of deterioration* . . . normal aging, heat, and flexing . . . Thermoflex A is unmatched. Especially effective as an inhibitor of flex cracking. Specify Thermoflex A for difficult jobs where only the best antioxidant protection will do.



ANTOX—Produces excellent aging stocks which discolor only slightly on exposure to sunlight. Antox also results in stocks having very good heat resistance. And, too, Antox activates cure . . . reduces accelerator requirements.

E. I. du Pont de Nemours & Co. (Inc.),
Wilmington 98, Delaware

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BETTER THINGS FOR BETTER LIVING
. . . *THROUGH CHEMISTRY*

Tune in to Du Pont "Cavalcade of America," Monday Nights—NBC Coast to Coast

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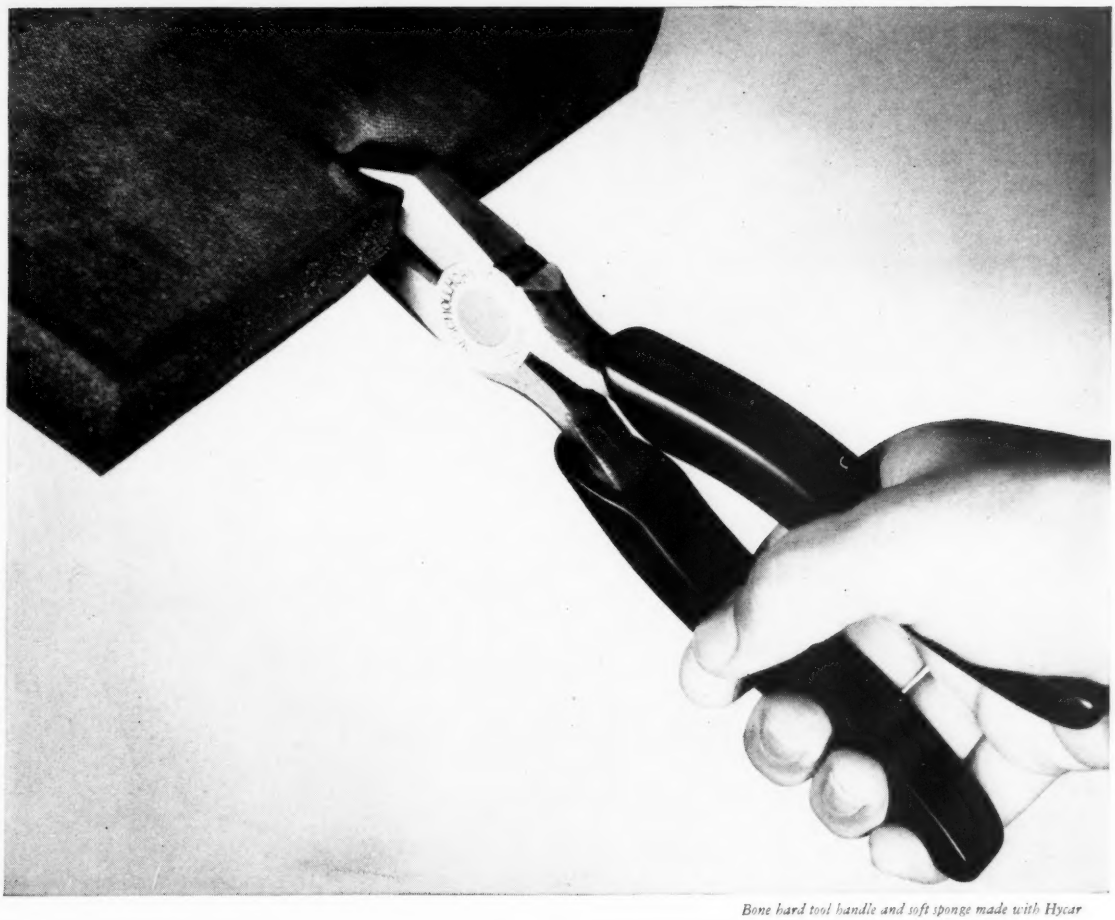


Bone hard tool handle and soft sponge made with Hycar

Do you want HARDNESS RANGE?

Hycar has it plus!

...AND THESE 8 OTHER ADVANTAGES!

1. Abrasion Resistance—50% greater than crude rubber.
2. Extreme Oil Resistance—insuring dimensional stability of parts.
3. High Temperature Resistance—up to 250° F. dry heat; up to 300° F. hot oil.
4. Minimum Cold Flow—even at elevated temperatures.
5. Low Temperature Flexibility—down to −65° F.
6. Light Weight—15% to 25% lighter than other American rubber.
7. Age Resistance—exceptionally resistant to checking or cracking due to oxidation.
8. Non-adherent to Metal—compounds will not adhere to metals even after prolonged contact under pressure. (Metal adhesions can be readily obtained when desired.)

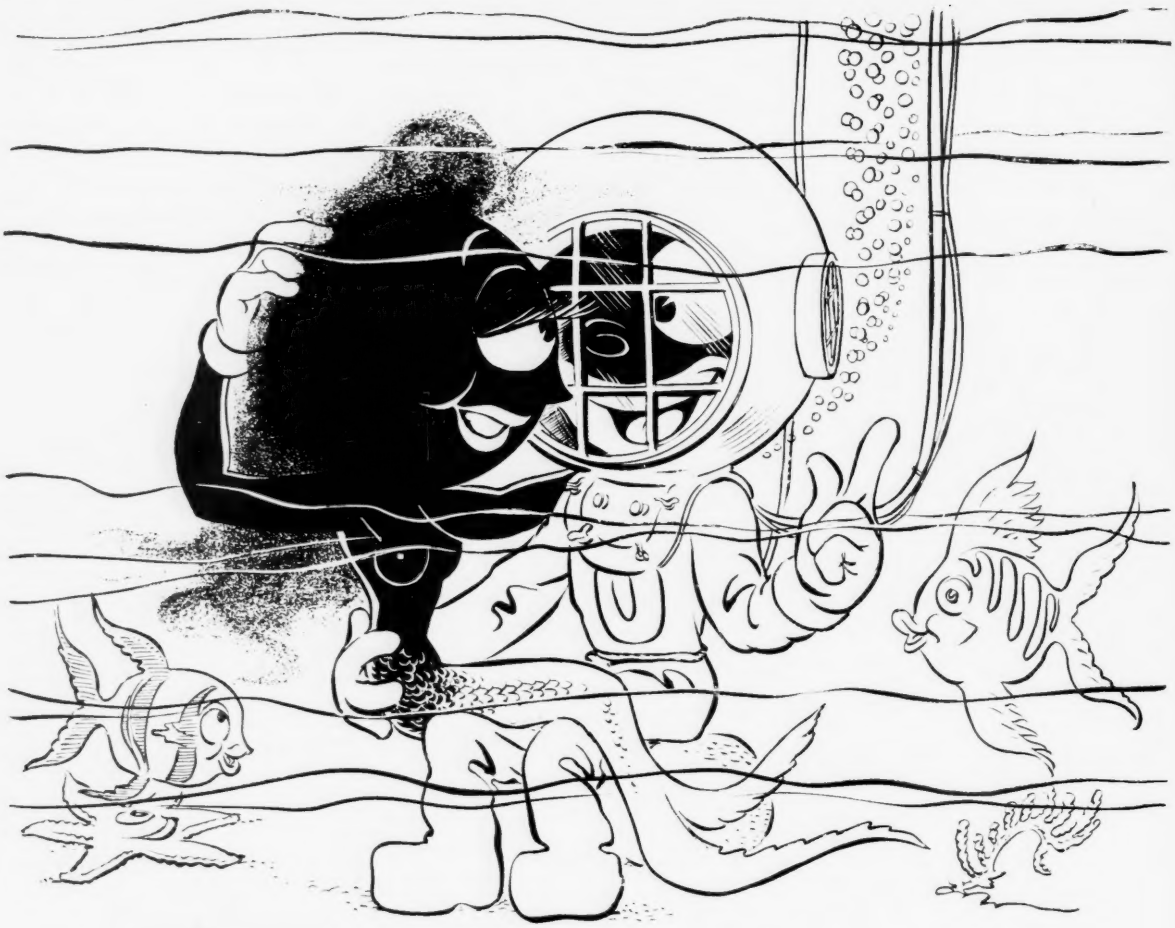
For more information, write or ask your supplier to write B. F. Goodrich Chemical Company, Dept. HA-5, Rose Building, Cleveland 15, Ohio.

Hycar
Reg. U.S. Pat. Off.
American Rubber

B. F. Goodrich Chemical Company

A DIVISION OF THE B. F. GOODRICH COMPANY

GEON polyvinyl materials • HYCAR American rubber • GOOD-RITE chemicals and plasticizers



Philonoist—*Seeker of knowledge*

Philblack O—*The HAF black that gets to the bottom of the problems at hand!*

You don't have to dive down very deep to come up with these important facts. Rubber products made with Philblack O have exceptional resistance to abrasion and remarkably good flex life. This HAF type black has proved itself particularly valuable in the reinforcement of "cold" rubber. This new chemical rubber and Philblack O are being proclaimed as the two most important advancements in the rubber industry in the past several years.

Until you have tried Philblack O you cannot realize all the advantages it offers. Send for a trial order, today, and write for a copy of "Philblack O and Philblack A in Natural and Synthetic Rubbers." It's just off the press.

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A SUBSIDIARY OF PHILLIPS PETROLEUM COMPANY

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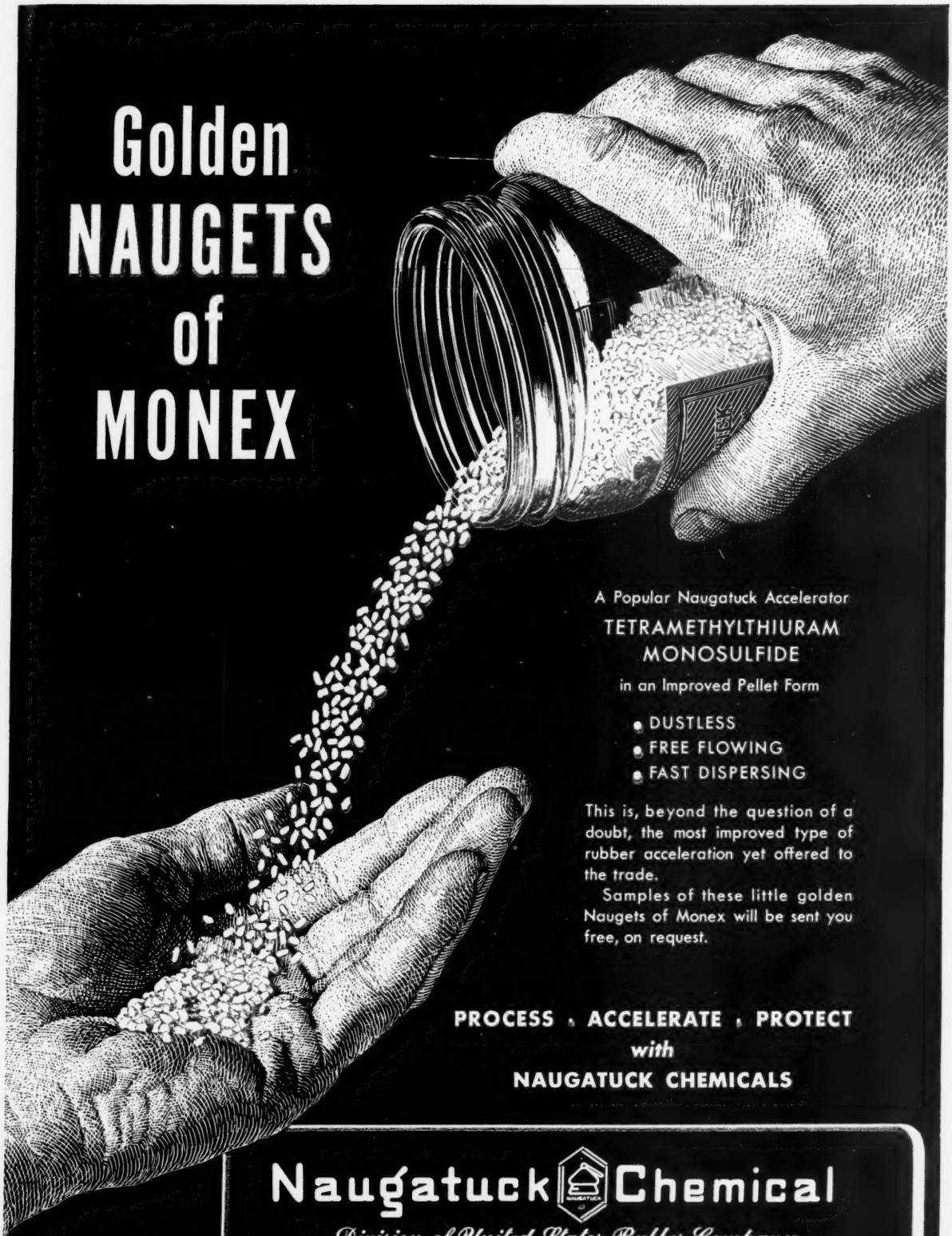
Warehouses in Akron, Boston, Chicago, and Trenton. West Coast agent: Harwick Standard Chemical Company, Los Angeles. Canadian agent: H. L. Blachford, Ltd., Montreal and Toronto.

Golden NAUGETS of MONEX



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TETRAMETHYLTHIURAM MONOSULFIDE

in an Improved Pellet Form

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- FREE FLOWING
- FAST DISPERSING

This is, beyond the question of a doubt, the most improved type of rubber acceleration yet offered to the trade.

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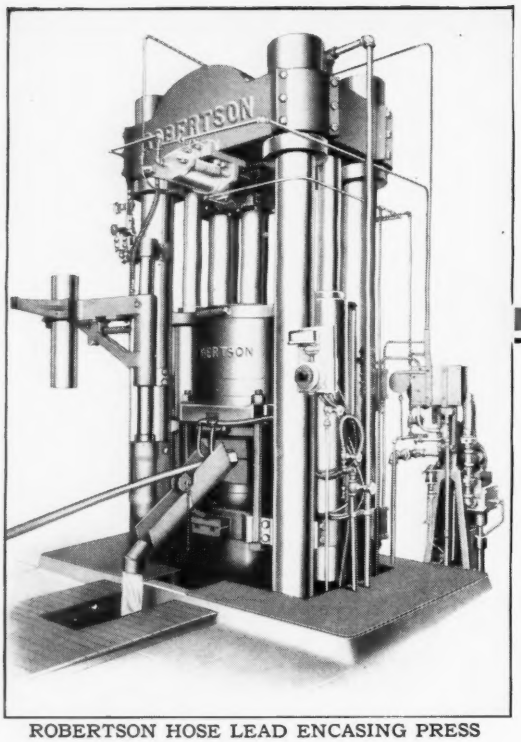
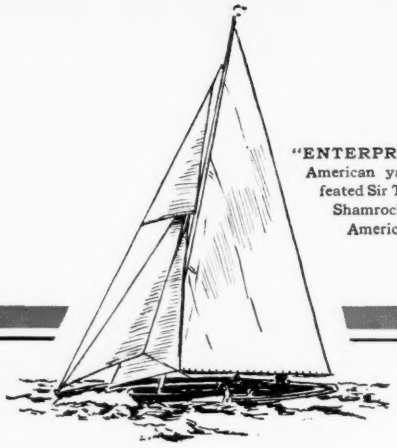


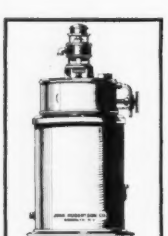
ROBERTSON HOSE LEAD ENCASING PRESS



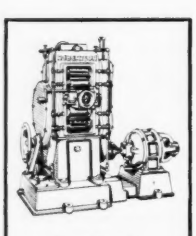
"ENTERPRISE"—The American yacht that defeated Sir Thomas Lipton's Shamrock V to win the America Cup Races, 1930.

"Custom-Built"

Like the famed *Enterprise* that was "custom-built" to win the America Cup Race, Robertson's Hose Lead Encasing Presses are "tailored" to the requirements of individual rubber hose manufacturers. Robertson engineers thoroughly examine all aspects of the installation—then the presses are carefully "custom-engineered" for the specific job. Well known firms like U. S. Rubber, Goodrich, Goodyear, Gates, DeVilbiss, Dunlap, Dominion Rubber, Swan Rubber, The Thermoid Company, Hewitt Robins and the Boston Woven Hose Company use Robertson Equipment to help turn out a goodly percentage of the world's fine rubber hose. . . . This is a tribute to Robertson's 90 years' experience in one line of work: producing fine high pressure hydraulic equipment.



Open Lead Melting Pot



Lead Sheath Stripping Machine

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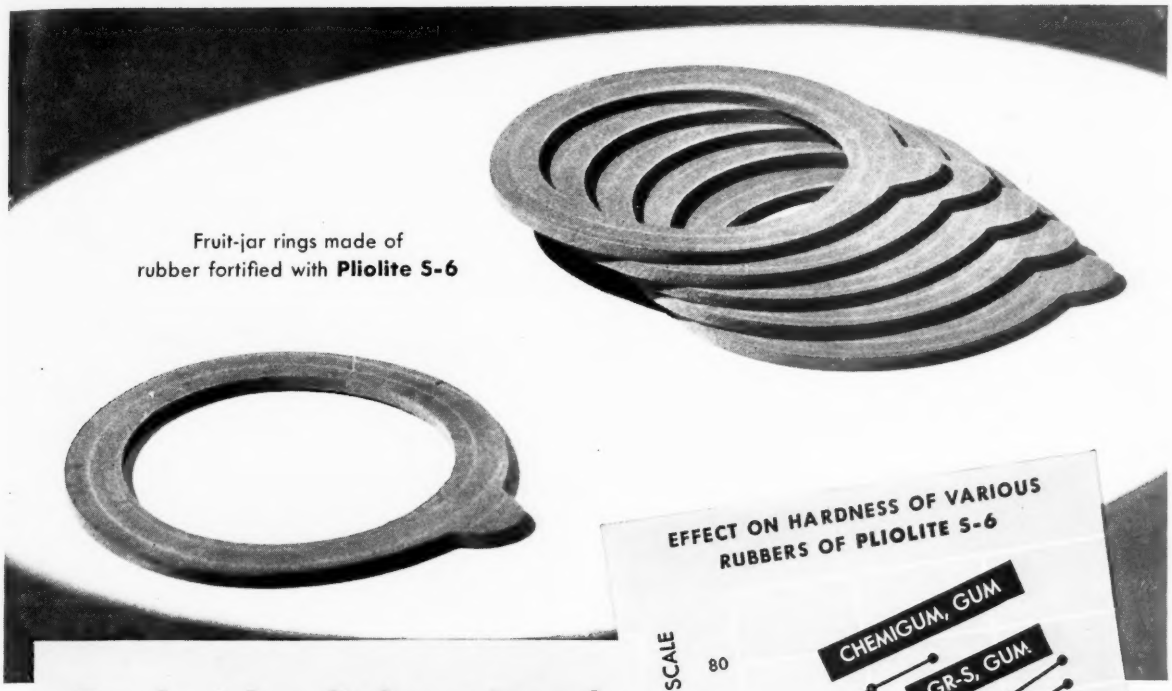
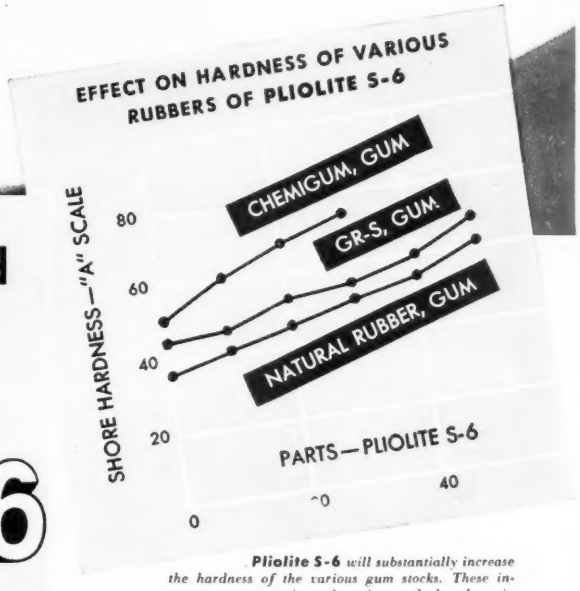
Designers and Builders of all Types of Lead Encasing Machinery
Since 1858



Fruit-jar rings made of
rubber fortified with **Pliolite S-6**

For harder, light-colored rubber stocks use

PLIOLITE S-6



***Pliolite S-6** will substantially increase the hardness of the various gum stocks. These increases are proportionately maintained when the resin is used in highly loaded black or non-black compounds.*

To add needed hardness to gum, colored or black natural rubber—and to synthetics as well—you can use **Pliolite S-6** with confidence. The chart shows you how varying percentages of **Pliolite S-6** copolymer resins added to various stocks produce a marked rise in Shore A scale hardness.

Users know that when **Pliolite S-6** is added to a stock, very high-hardness values can be obtained while the stock still keeps excellent toughness and durability. And **Pliolite S-6** helps eliminate scrap. It acts as a plasticizer at elevated temperatures, improves calendering and plate polishing. And it prevents shrinkage as the stock cools.

Where colored stock is used, **Pliolite S-6** is particularly suited as a replacement for carbon black, since, with other loading, it produces compounds that are light in color, low-gravity, and with 70 to 100 durometer hardness. They're highly moldable, and have excellent processing characteristics as well.

Pliolite S-6 can be obtained as a powder for your own mixing, or in master batches. Write for sample and full details to Goodyear, Chemical Division, Akron 16, Ohio.

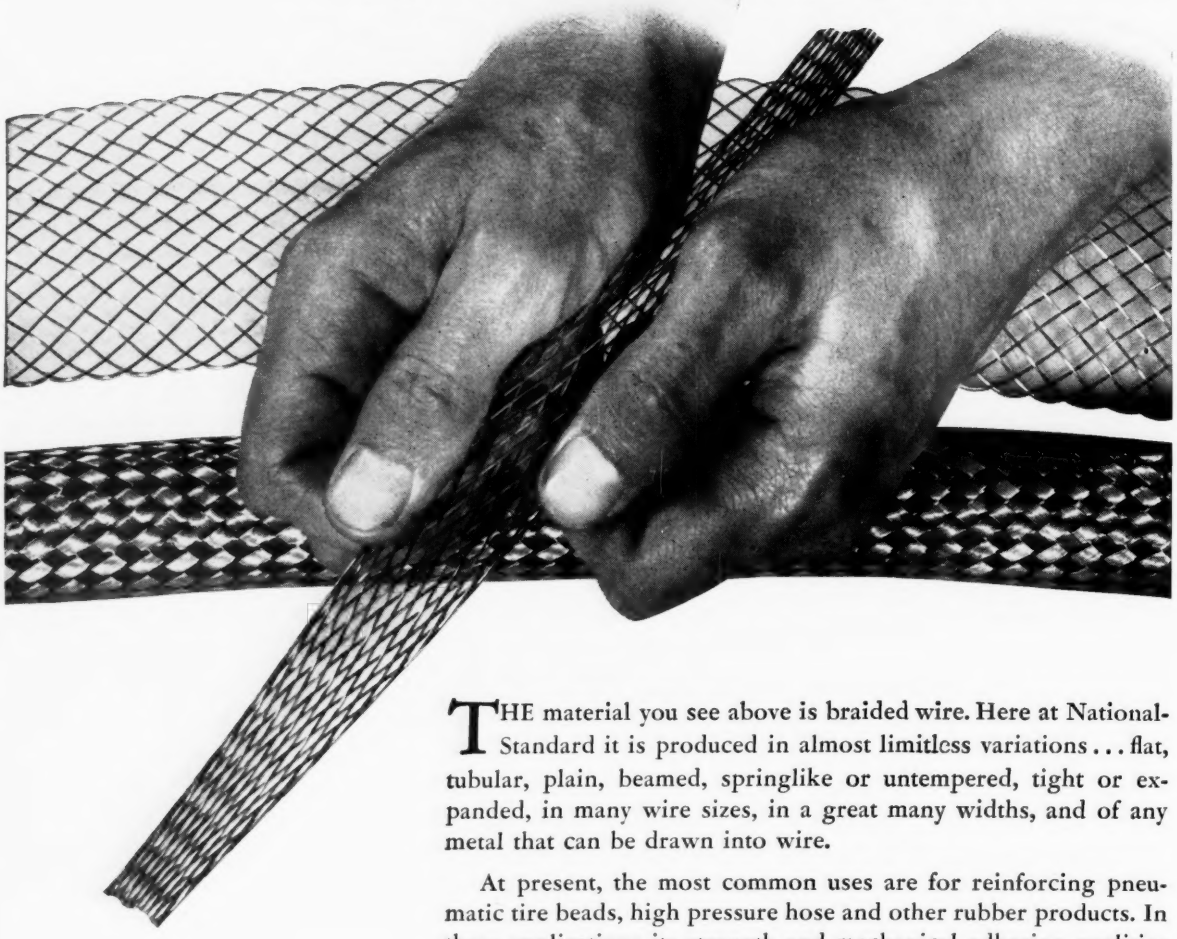
USE PROVED *Products*

GOODYEAR

Pliolite, Chemigum (pronounced Kem-e-gum)—T. M.'s The Goodyear Tire & Rubber Company

Tough...flexible...decorative...

maybe it can give you ideas!



THE material you see above is braided wire. Here at National-Standard it is produced in almost limitless variations . . . flat, tubular, plain, beamed, springlike or untempered, tight or expanded, in many wire sizes, in a great many widths, and of any metal that can be drawn into wire.

At present, the most common uses are for reinforcing pneumatic tire beads, high pressure hose and other rubber products. In these applications its strength and mechanical adhesion qualities are unsurpassed.

Considering its limitless variations and unique qualities, braided wire is bound to have many other effective applications. Perhaps it can save or make money for you! An interesting possibility, for example, is its use with transparent plastics to produce pleasing patterns as well as reinforcement.

If all this gives you an idea you'd like to explore, be assured that National-Standard, as usual, is ready to cooperate with you all the way. Let's talk it over. Just get in touch with the *National-Standard Company, Niles, Michigan.*

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NATIONAL-STANDARD
Company
NILES, MICHIGAN

DIVISIONS OF NATIONAL-STANDARD CO.

ATHENIA STEEL	*Clifton, N. J.*	Flat, High Carbon, Cold Rolled Spring Steel
NATIONAL-STANDARD	*Niles, Mich.*	Tire Wire, Fabricated Braids and Tape
WAGNER LITHO MACHINERY	*Jersey City, N. J.*	Lithographing and Special Machinery
WORCESTER WIRE WORKS	*Worcester, Mass.*	Round Steel Wire, Small Sizes

How Marvinol® Vinyl Resin improves these products... speeds up their production

MARVINOL VINYL RESINS have proved their advantages under severest testing conditions. To products such as these, they give extra toughness and dryness, superior dimensional stability, greater flexibility at low temperatures. In rigid, semi-rigid and elastomeric formulations, Marvinol VR-10 is paying manufacturers by increasing product quality and speeding up processing.

Marvinol processes faster because it offers you shorter pre-mix, open mill and Banbury cycles...faster extrusion cycles. Marvinol is extruded to make tough, chemical and abrasion resistant continuous cross-sectional shapes... calendered into sheets and free films where its tear resistance, flexibility and dryness pay big dividends...adaptable to rapid cooling methods in injection molding...dispersed to make excellent film, coatings and slush molded pieces.

Test this remarkable vinyl polymer. Send for details about Marvinol. While The Glenn L. Martin Company does not compound or fabricate in the plastics field, we do sell raw materials to processors and will be glad to refer you to one of our customers if you're interested in Marvinol. Write today to Chemicals Division, Dept. I-5, THE GLENN L. MARTIN COMPANY, BALTIMORE 3, MARYLAND.

MANUFACTURERS OF: Dependable Martin 2-0-2 airliners • Advanced military aircraft • Revolutionary rockets and missiles • Electronic fire control systems • Versatile Marvinol resins (Martin Chemicals Division) **DEVELOPERS OF:** Mareng fuel tanks (licensed to U.S. Rubber Co.) • Stratovision aerial re-broadcasting (in conjunction with Westinghouse Electric Corp.) • Honeycomb construction material (licensed to U.S. Plywood Corp.) • New type hydraulic automotive and aircraft brake • Permanent fabric flameproofing. **LEADERS IN RESEARCH** to guard the peace, build better living in far-reaching fields.

Martin® Marvinol®

RESINS, PLASTICIZERS AND STABILIZERS PRODUCED BY THE CHEMICALS DIVISION OF

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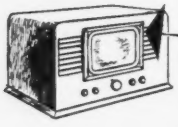
"BETTER PRODUCTS, GREATER PROGRESS, ARE MADE BY MARTIN"

TITANOX-A

improves the Rubber Mask that improves the Video picture



This rubber television mask acts primarily as a shock absorber, of course. Yet experience has shown it actually improves the visibility of the video picture.

In the mask, as in many other rubber products, TITANOX-A (titanium dioxide) contributes high reflectance and *lasting* whiteness.

Whether the natural or synthetic rubber you compound is for television masks or white sidewalls . . . colored bathing caps or bright beach balls . . . you can depend upon TITANOX titanium dioxide or composite titanium calcium pigments to impart the desired degree of whiteness or clarity of tint . . . brightness . . . complete opacity or controlled translucency.

You are always welcome to discuss with us your problems in white pigmentation of rubber. Titanium Pigment Corporation, 111 Broadway, New York 6, N. Y.; 104 So. Michigan Ave., Chicago 3, Ill.; 2600 So. Eastern Ave., Los Angeles 22, Calif. Branches in all other principal cities.

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the brightest name in pigments

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UNITED CARBON COMPANY, INC.

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United Blacks

KOSMOS 20

KOSMOS 20—An SRF type carbon black, possesses perfect balancing of all component properties essential to satisfactory rubber performance; outstanding for ease of processing, good plasticity, fast rate of cure, high resiliency, and low heat build-up.

KOSMOS 40

KOSMOS 40—An HMF type carbon black with these properties—cool mixing, smooth and rapid extrusion, fast rate of cure, high resistance to cut-growth, flex cracking and abrasion. Produced by a special process. This furnace type black is especially useful for tires, tubes, footwear, and mechanical goods.

KOSMOS 50

KOSMOS 50—An HMF oil base furnace black specially developed as a processing aid for channel black, inducing smooth, fast and clean cut extrusion, low and even shrinkage, and its stocks have clean edges and no surface roughness. KOSMOS 50 requires no added acceleration at increased black loadings and gives higher reinforcement at lower loadings, is economical for stock where extreme resistance to abrasion is not mandatory.

KOSMOS 60

KOSMOS 60—An RF oil base furnace black, specially developed to deliver remarkably high reinforcement and superior resistance to abrasion and to flex crack cut-growth. KOSMOS 60 is a guide to rapid, smooth extrusion and low shrinkage, and requires no added acceleration at increased black loadings. KOSMOS 60 provides high electrical conductivity.

UNITED CARBON COMPANY, INC.

CHARLESTON 27, W. VA.

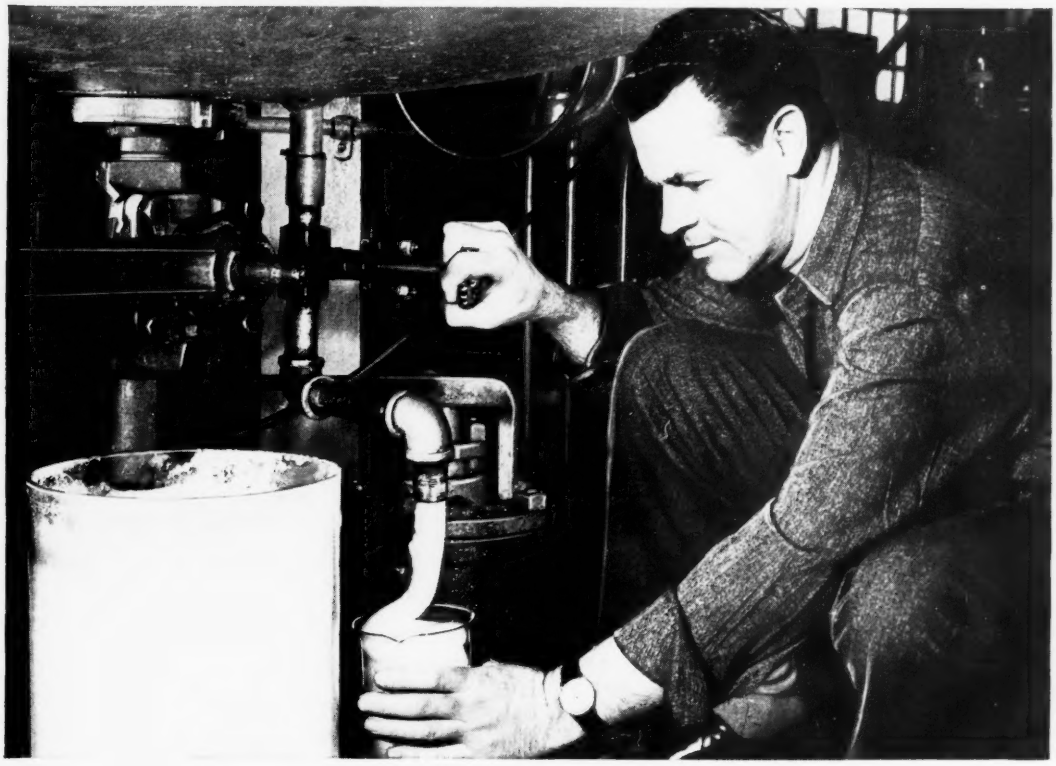
NEW YORK • AKRON • CHICAGO • BOSTON

Now a Goodyear Synthetic Latex to meet every need

CHEMIGUM **rubber latices**

PLIOLITE **resinous latices**

Goodyear synthetic latices have good to excellent storage stability.



Now Goodyear offers you a choice of synthetic latices — either rubber or resinous. One of these materials is certain to fill your needs for an aqueous dispersion. They've been engineered to offer a range of properties to meet a wide grouping of problems. Or these latices can be successfully compounded to meet specific needs as well.

Rubber members of the family are **Chemigum** latices 101A, 101E and 200—used for dipped goods, wire insulation, paper coating and impregnation, fabric coating and sizing, adhesives and water emulsion paint additives.

The resinous latices are **Pliolite** latices 150, 170 and 190—for reinforcing rubber latices, coating papers and fabrics, in sealers for wood composition board and plaster, in water emulsion paints and in adhesives.

For the details on the physical properties and the compounding of these latices write Goodyear, Chemical Division, Akron 16, Ohio.

USE PROVED *Products*

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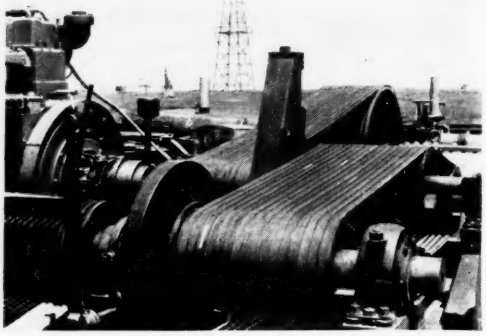
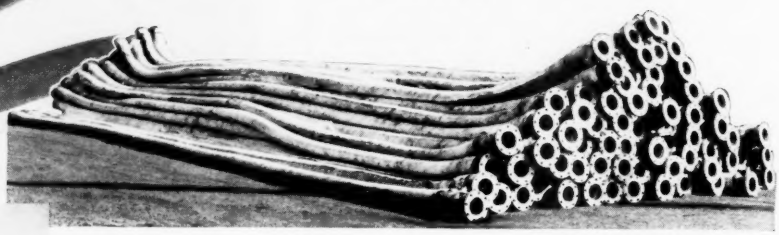
Chemigum, Pliolite—T.M.'s The Goodyear Tire & Rubber Company

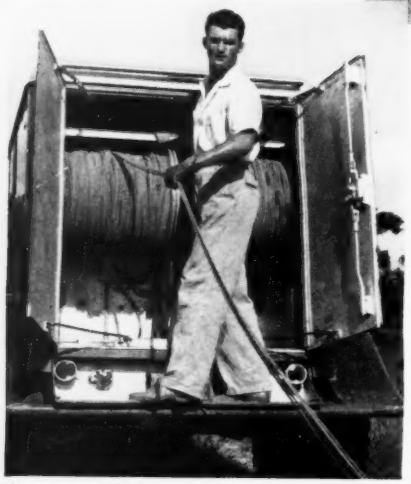
Neoprene casters for industrial trucks. Courtesy L. H. Gilmer Company, Division U. S. Rubber Company.



V-Belt drive on mechanical rotary drilling oil jig. Courtesy L. H. Gilmer Company, Division U. S. Rubber Company.



Neoprene oil suction and discharge hose for marine service. Courtesy Quaker Rubber Corporation, Philadelphia.



Neoprene covered seismograph cable. Courtesy General Geophysical Company.

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K&M LIGHT MAGNESIUM OXIDE

for products that must do a hard day's work

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For your neoprene products—no matter what their ultimate use—there are advantages to be gained by using K&M Light Magnesium Oxide. Write to us, or to our distributor listed below.

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under the brand name

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RAY-BRAND
Regd. Trade Mark

RCMA Latex and Latex Concentrates are produced in Sumatra, Netherlands East Indies, and as in prewar days they are known for their excellence. RCMA Latex is prepared under expert technical supervision and uniform quality is assured by a steady flow of latex from the large plantations owned and operated by N. V. Rubber Cultuur Maatschappij "Amsterdam".

RCMA 61-63% Centrifuged Latex is now available for shipment in tank cars, tank trucks and drums.

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BEACOFINISH—a unique family of coating materials conceived to give your products greater durability and eye appeal. These highly concentrated wax emulsions that can be diluted with up to four parts of water can be used with the utmost safety and economy.

BEACOFINISH is therefore of four-fold importance to you:—

1. ***It Protects*** your products against their natural enemies—air, sunlight, moisture and excessive handling.
2. ***It Improves*** the appearance of your product for its uniform coating stimulates greater consumer interest.
3. ***It's Economical*** because its high dilution potential (without losing efficiency) allows one gallon to cover 15,000 sq. ft.
4. ***It's Safe*** being a wax in water emulsion, it eliminates the fire and health hazards of volatile-solvent based finishes.

BEACOFINISH can be applied by dipping, sponging, spraying or brushing—dries in about 20 minutes—faster if force-dried—to give a hard protective coating of great elasticity.

BEACOFINISH may be ordered in Neutral or Black, in varying degrees of luster from brilliant to dull. It is so concentrated, from one drum you can obtain potentially up to five drums of superior coating for your products.

CONSULT US—WRITE US TODAY

Let us show you how BEACOFINISH can make your products more attractive and saleable—protect them from damage—you from loss—in production and transit!

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Compare delivered volume costs of CALCENE T SILENE EF with those of other reinforcing pigments

A study of *delivered volume costs* of reinforcing pigments for your products may reveal economies through the use of Calcene T or Silene EF. In addition, these Columbia pigments can be used for white or colored stocks.

We'll be glad to provide data for making comparative analyses. Just write Pittsburgh Plate Glass Company, Columbia Chemical Division, Fifth at Bellefield, Pittsburgh 13, Pa.

*__CALCENE T__—A specially prepared, white, coated, precipitated calcium carbonate of fine particle size—confers high tensile strength, resistance to tear and abrasion, low modulus, smooth, fast extrusion and good general processing properties to natural and synthetic stocks.

*__SILENE EF__—A very finely divided, white, precipitated, hydrated calcium silicate—confers high modulus, hardness, tear resistance, and good tensile strength up to high loadings. Especially desirable for hard abrasion resistant natural and synthetic stocks.

*Registered U. S. Patent Office.

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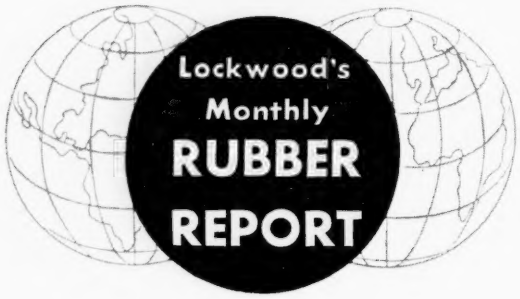

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This is a monthly service for those firms who wish to keep completely informed of current developments in the rubber commodity field. It supplies facts, opinions and forecasts from Washington and every rubber producing area in the world. Air-mail dispatches from London, Paris, Amsterdam, Malaya and the Far East. It obtains authoritative original opinions from leading rubber experts on subjects of current importance. It analyzes legislative trends and government policy developments in Washington. It summarizes the "business climate" each month. "RUBBER REPORT" is edited by Warren S. Lockwood and H. C. Bugbee. It is the most quoted and authoritative review of the month-to-month rubber situation available. Mailed to subscribers in the U. S. and twenty overseas countries on the 15th of every month from W. S. Lockwood, Inc., 1631 K Street, N. W., Washington 6, D. C.

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Farrel-Birmingham engineers have developed four separate variations of the single basic principle — *mastication and extrusion by screw action.*

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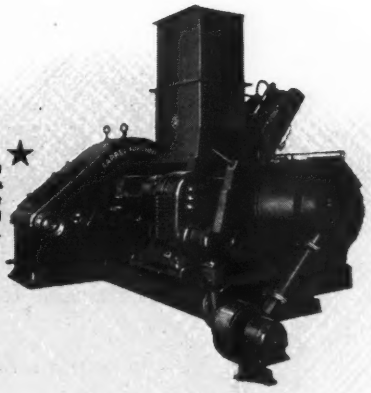
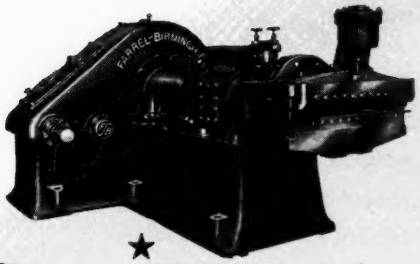
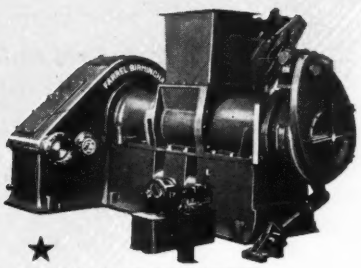
Write for full information about any one of these extrusion specialists. No obligation.



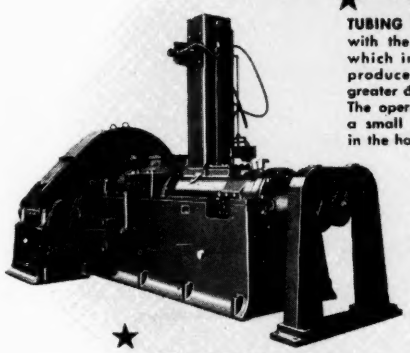
★ **PELLETIZERS** for producing free-flowing rubber pellets which provide more efficient and economical handling and storage, and quicker processing.



★ **TUBING MACHINES,** equipped with the exclusive roller feed which increases output and produces rubber stocks of greater density and uniformity. The operator merely maintains a small rolling bank of stock in the hopper.



★ **OTHER EXTRUDING MACHINES,** built for a variety of applications in processing rubber and plastics stocks. This strainer receives stock directly from Banbury mixer, eliminating the need for sheeting mill.



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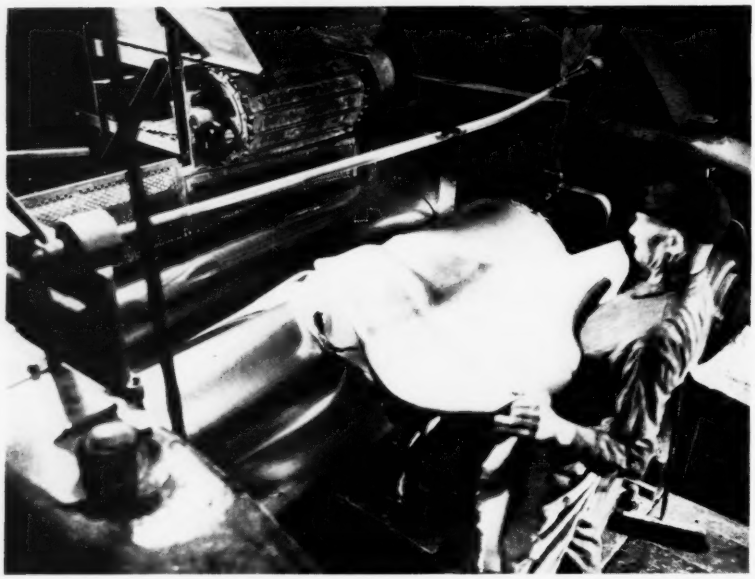

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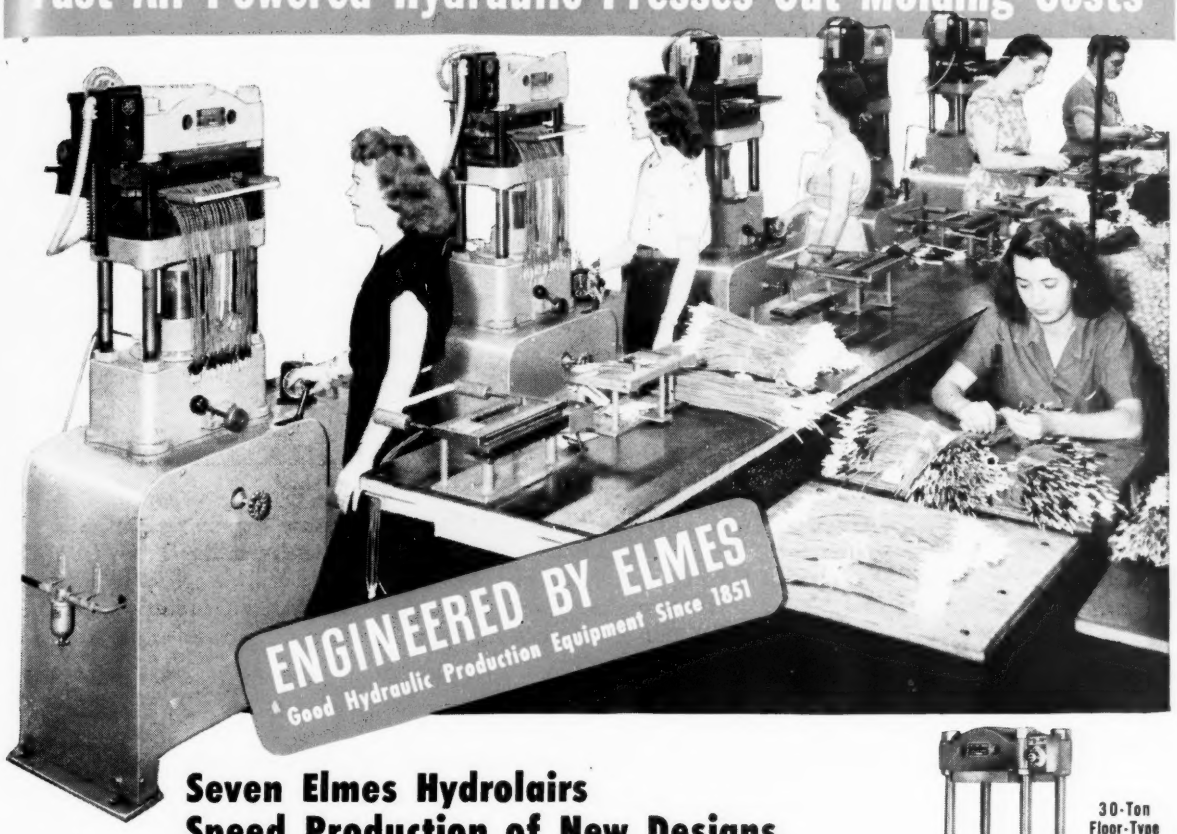

Seven Elmes Hydrolairs Speed Production of New Designs at Belden Mfg. Co.

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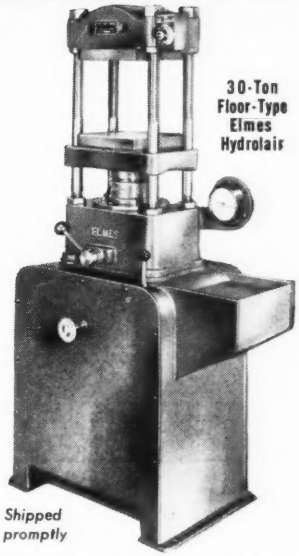

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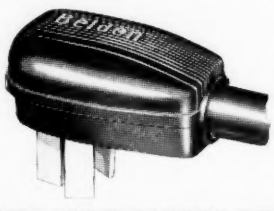

These new Belden one-piece rubber plugs, Hydrolair-molded around electric power cords, eliminate former complex plugs held by rivets.

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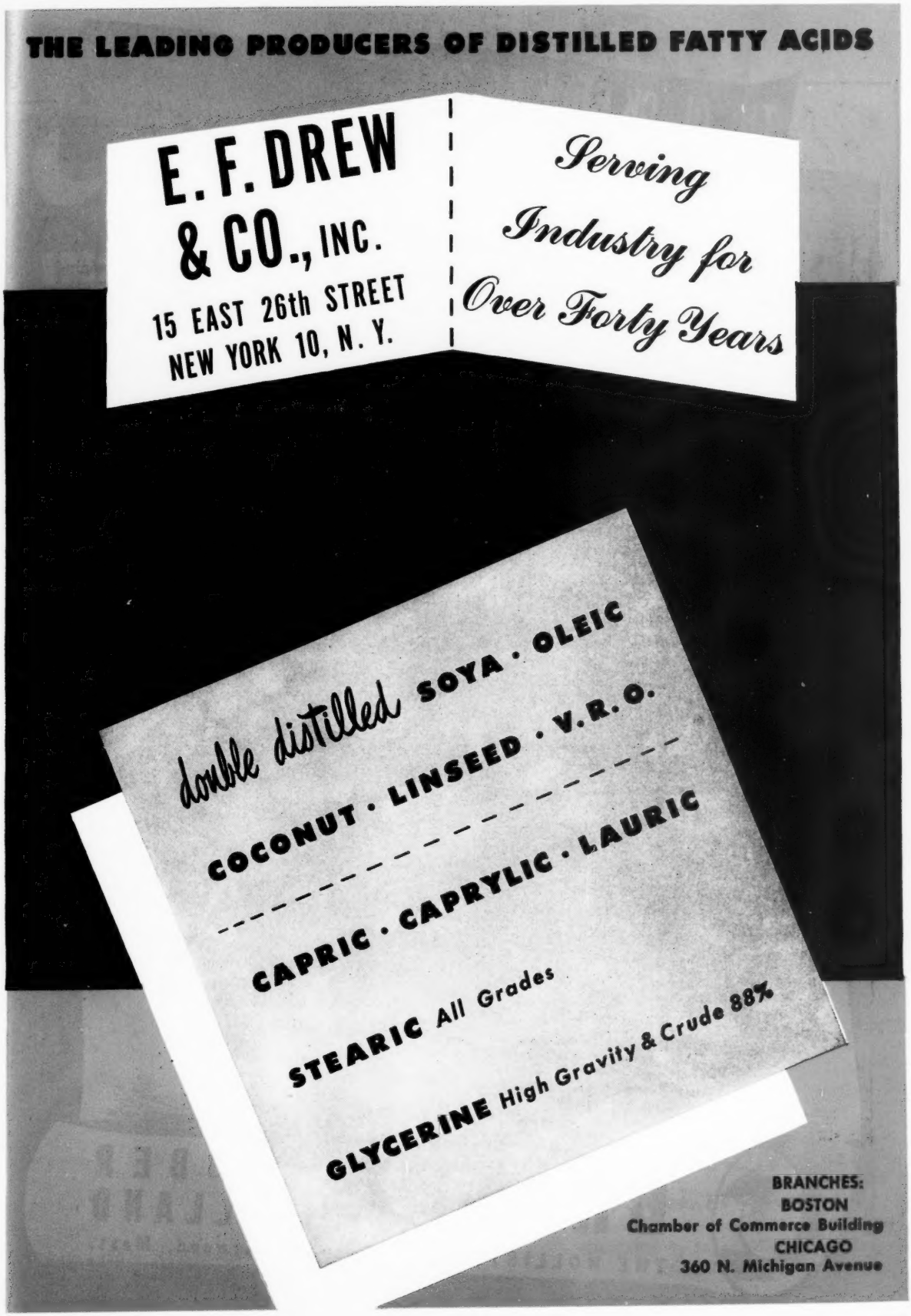
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THE BLACK ROCK 4A-20

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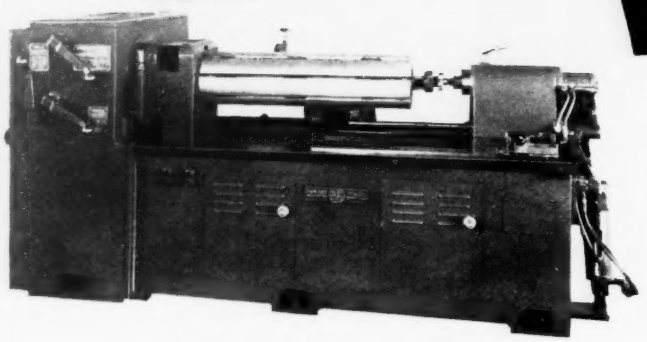

Inquire how the *Black Rock 4A-20* will solve your washer cutting problem . . . inexpensively, quickly and *AUTOMATICALLY.*

. . . handling sleeves made of rubber, synthetics, fabrics, paper, etc., ranging from 9″ to 20″ O.D., having a maximum wall thickness of 1¾″. Cuts from 1/32″ to 1″ in width may be obtained.

Loading and unloading is facilitated by use of latest type expanding mandrels and air actuated disappearing tailstock. Mandrels are power operated and four sizes cover the range of the machine. All controls are within easy reach.

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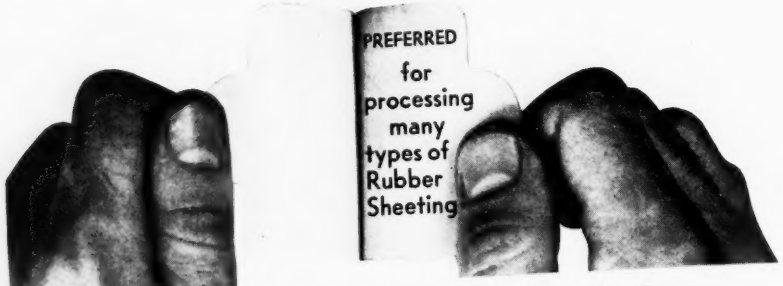
A Shining Example



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Three standard qualities. 20 and 40 inches wide, in 100 and 250 yard rolls. Special size rolls to order.

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CRYSTEX
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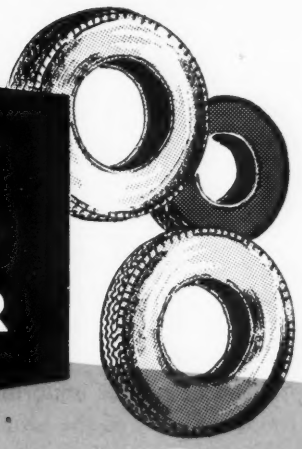

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If you have not in recent months checked the feasibility of using CRYSTEX in your operations, we suggest you do so, as the price of this Insoluble Sulphur is lower today than at any time.

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Precision Calendering for Uniformityan

PROGRESSIVE rubber manufacturers are constantly striving for greater uniformity in their product. This is particularly true in the case of tires for passenger automobiles, where tire unbalance must be minimized due to the high speeds. Precision calendering is the answer to this problem of greater uniformity.

To illustrate the magnitude of the problem of producing a uniform product with existing standard-type calenders, the chart at right should be of value. It shows the non-uniformity of ordinary calendering methods during a regular production run on a standard sleeve-bearing rubber calender. The chart is calibrated to indicate variations over and under the standard weight of coated fabric in ounces per square yard.

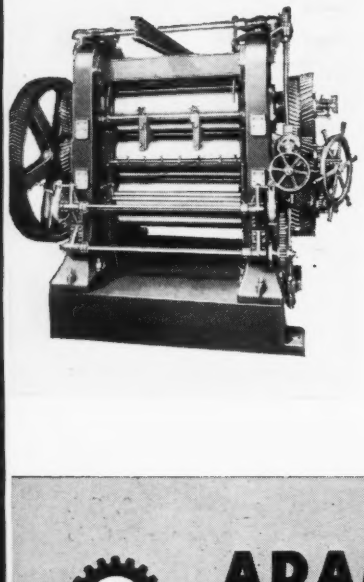
Allowable variation is one-half ounce, light or heavy. It is apparent that this tolerance has been exceeded during a substantial portion of the eight-hour run. However, the results shown are not at all unusual since they represent the accuracy normally obtained with a well maintained sleeve-bearing calender.

An examination of the chart between noon and 1:00 P.M. shows that during this time, the calender exceeded tolerances on the light side for six periods averaging two and one-half minutes each, or a total of fifteen minutes. On the other hand, excessive tole ances on the heavy side occurred during five perio averaging two minutes each, or a total of ten minute Inasmuch as this calender was operated at a speed fifty yards per minute, it is obvious that about 7 yards of fabric were actually lighter than the accep able minimum, and 500 yards were heavier than th prescribed maximum.

Present practice allows acceptance of any complete roll of fabric which weighs within certain limits. Th above example illustrates how non-uniform weight of yardage can occur, even though the finished ro passes the final weight inspection.

It is apparent therefore, that existing calenders ar delivering a product which may have, on one hand under-weight stock with consequent quality risk i the final product and, on the other hand, waste ma terial due to excessive gauges.

We invite your attention to the specifications given below, comparing features of the old-style calende with those of the modern precision calender. A study of these specifications illustrates the reasons why th modern precision calender is so well suited for im proving quality and uniformity of finished product.



COMPARISON OF SP

Typical Old Style Calender in Current Use

ROLLS:

. . . are chamber bored. Temperature differences between center and ends of roll face affect roll crown and contour.

ROLL BEARINGS:

. . . full bronze lined, arranged for grease or force feed oil lubrication. There are no seals at ends of box to prevent leakage of lubricant onto roll face. Sufficient running clearance must be allowed for operation of rolls at topmost temperatures.

ROLL CROWN:

Rolls are ground with proper contour to produce uniform gauge on most popular stock. Other stocks of different hardness and seperating forces cannot be run at uniform gauge.

ROLL ADJUSTMENT:

Adjustment of all rolls is obtained through single hand wheel or motor. Top roll operates thru a screw that lifts top roll bearing boxes by means of a lifter plate.

GEARING:

Connecting gears, with cut double-helical teeth, are mounted on the rolls, together with bull gear and pinion which supply the power to the middle roll. These are enclosed in oil-tight, light metal gear guards so that bottom gears can dip in oil bath and carry lubricant to top gears.

ROLLS:
. . . are
longitudi
Uniform
prevent

ROLL
Equippe
justed t
controlle
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nation.
exact co

ROLL
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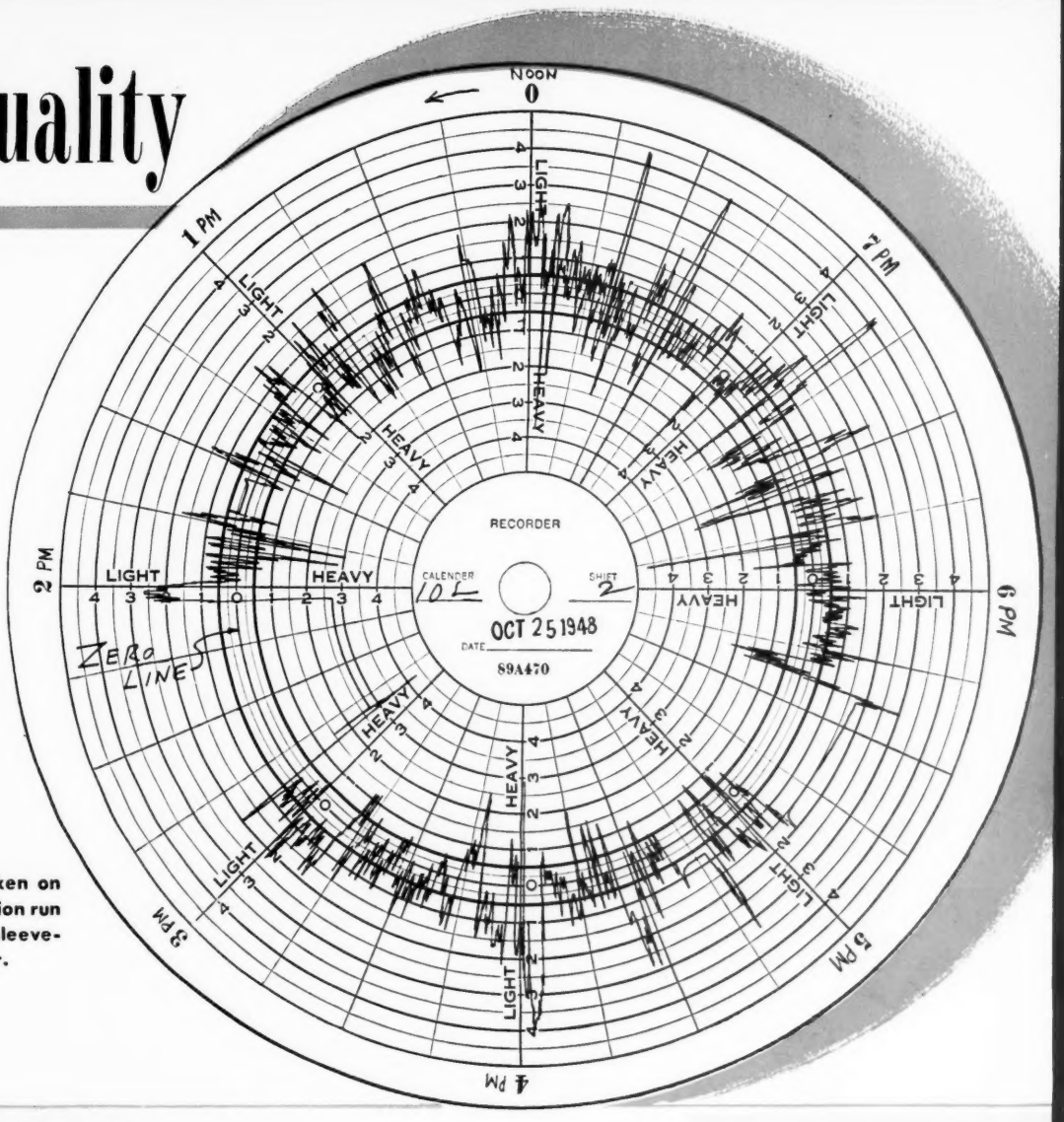


Weight Chart taken on a regular production run of a standard sleeve-bearing calender.

SPECIFICATIONS

Adamson United New Precision Calender

ROLLS:

. . . are arranged for cooling and heating through longitudinal holes drilled near periphery of the roll. Uniform temperatures at center and ends of roll prevent uneven expansion and hold original contour.

ROLL BEARINGS:

Equipped with precision-type roller bearings adjusted to zero clearance, flood oil lubricated at controlled temperature. Close fitting seals effectively retain all lubricant, preventing stock contamination. Rolls are ground in own bearings to assure exact concentricity under operating conditions.

ROLL CROWN:

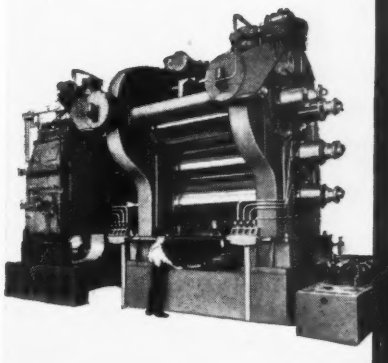
Adjustment for variable roll deflection obtained by crossing roll axes. Wide variety of stocks can be run with complete uniformity of gauge.

ROLL ADJUSTMENT:

Top roll stabilized by hydraulic push-back devices, which remove clearance from the screwdown mechanism. Leveling of individual rolls accomplished by push-button controls, located for operator's convenience.

GEARING:

Each roll is individually driven through a universal spindle, permitting crossing the roll axes to compensate for roll deflection. A separate pinion stand mounts the fine-pitch roll connecting gears in a rigid housing. Connecting gears run on fixed centers, and are oil flood lubricated.



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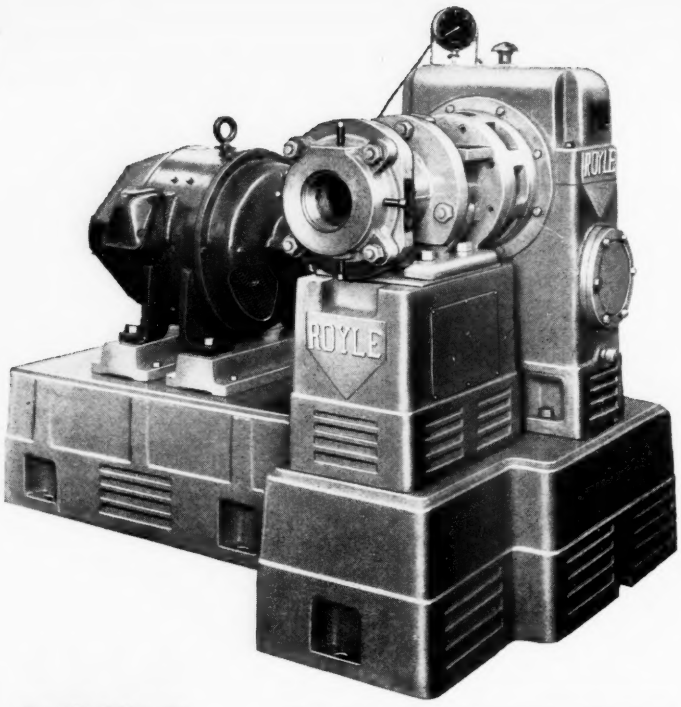

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FOR RUBBER COMPOUNDING

SYNVAR RESINS

- **Compatible with Buna N and GR-S types of rubber**
- **Can also be used advantageously with Natural rubber and Neoprene**
- **Improves processing and molding**
- **Improves the following:**

  Hardness
  Chemical Resistance
  Toughness
  Abrasion
  Heat Resistance
  Mechanical Properties

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Wilmington 99, Delaware

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ALBALITH-73

(LITHOPONE)

Imparts High Resilience

Albalith-73, a special surface-treated lithopone, provides superior resilience characteristics, together with high tensiles and tear resistance.

The pendulum rebound and heat generation properties of Albalith-73 are slightly better (as shown below) than those of the higher reinforcing Protox-166 Zinc Oxide* at an equal volume loading.

TABLE OF DATA

Time of Cure Min. at 30 Lb.	Goodyear-Healey Pendulum			Compression Fatigue (Goodrich Flexometer)**				
	Indentation in mm.	Per Cent Rebound	Shore Hardness	Per Cent Initial Comp.	Running Time and Per Cent Permanent Set	Max. Temp. Rise °C.	Dynamic Compression Initial	Dynamic Compression Final
ALBALITH-73								
60	9.38	85.2	46	20.8	15'-1.8	7.0	6.1	6.1
PROTOX-166 ZINC OXIDE								
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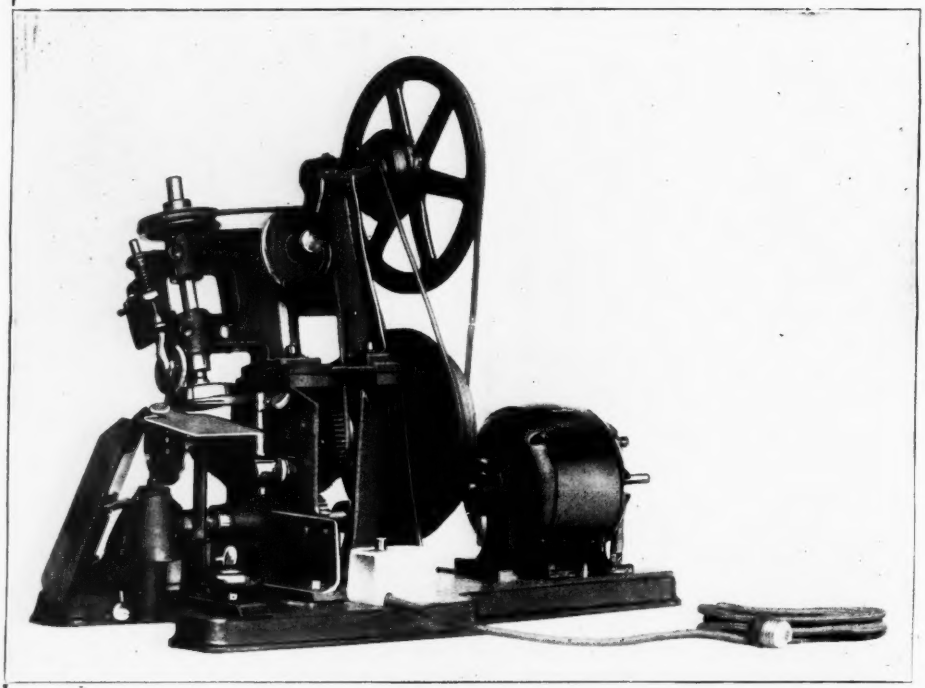

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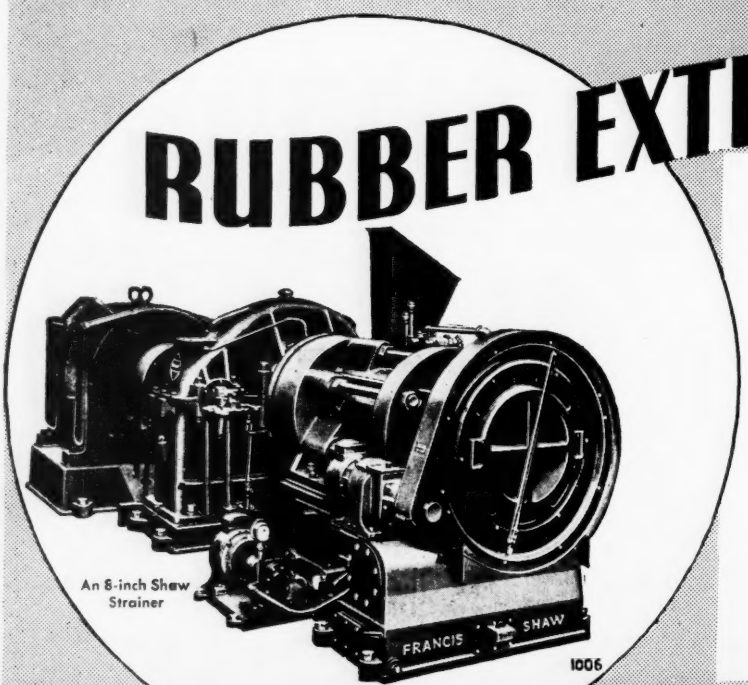

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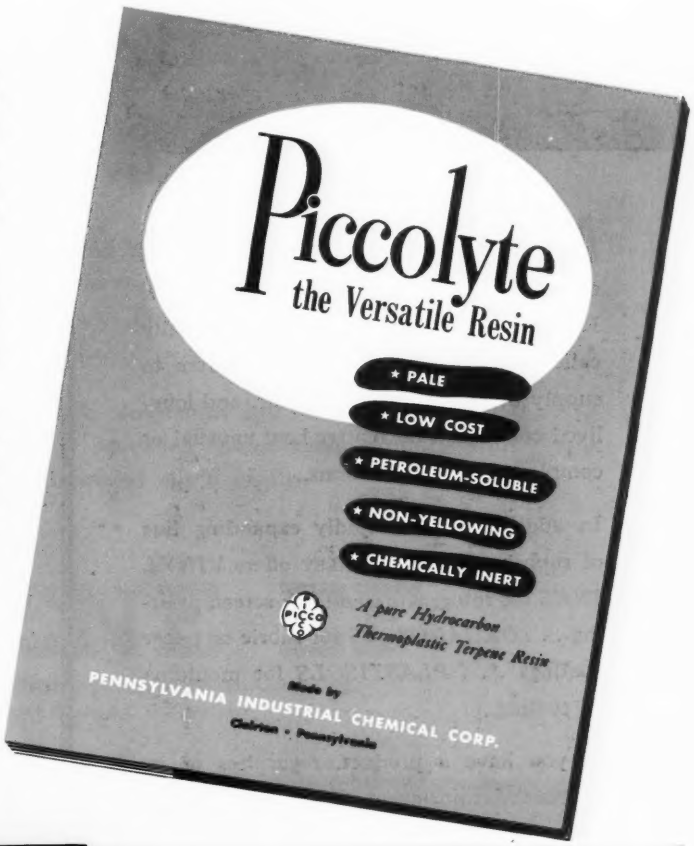

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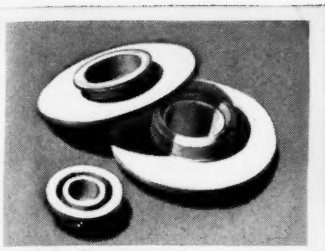

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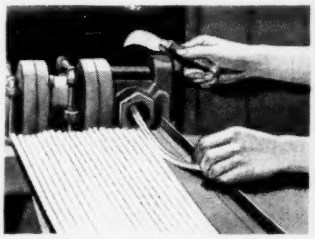

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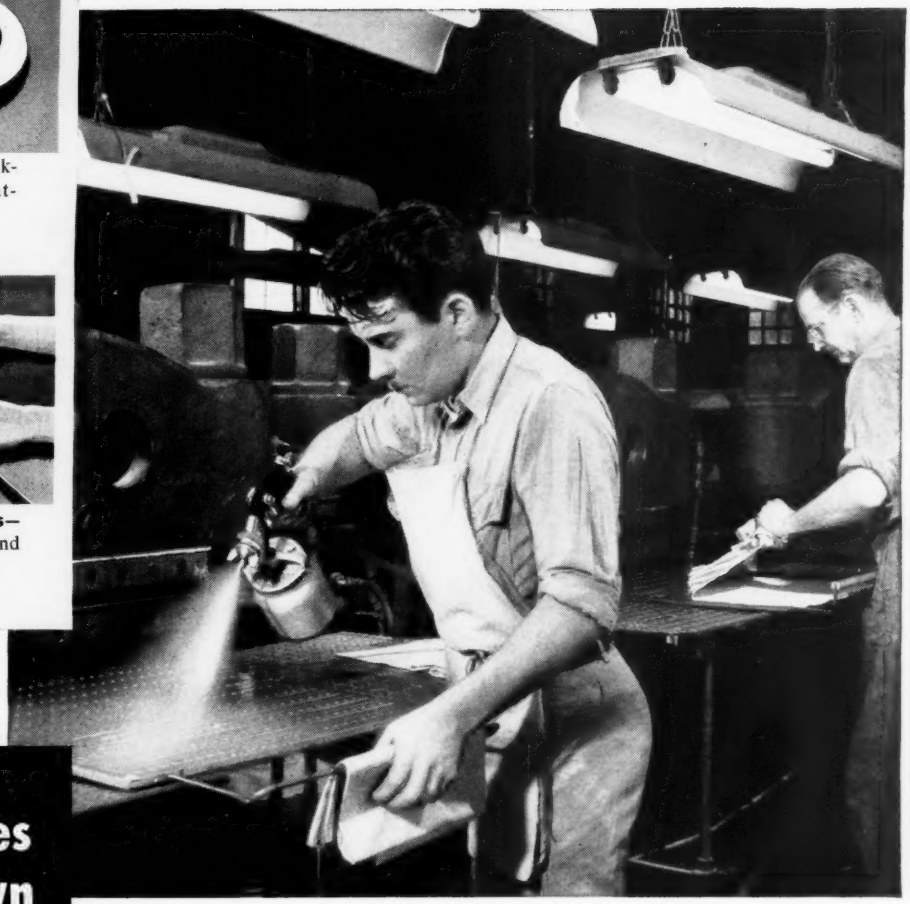

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Volume 120 Number 2

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RUBBER WORLD

Volume 120 New York, May, 1949 Number 2

Rubber Technology and Research In Western Europe[1]

Lawrence A. Wood[2]

THREE years after the end of the war an International Rubber Technology Conference in London afforded an opportunity for about 20 Americans to observe the present status of rubber technology and rubber research in Western Europe. As one of them, I was fortunate enough while in Europe to be able to visit France, Switzerland, the Netherlands, and England and to compare the present status of research in those countries with that in 1938, when I attended the first International Rubber Technology Conference sponsored by the Institution of the Rubber Industry. This time I saw nothing of the German developments, which, of course, have been rather completely described in the reports of the many observers who were sent to Germany at the end of the war. I shall attempt to present a unified picture of rubber technology in the four countries I visited, stressing, of course, those features most closely related to our work at the National Bureau of Standards.

Rubber Research and Manufacturing in France

The French rubber industry is now consuming about 90,000 long tons of rubber a year. The production in French Indo-China is about 40,000 long tons a year; the balance is obtained from various sources. No synthetic rubber is being produced or imported on any appreciable scale. There is a severe shortage of tires because of the government's insistence on the export of about 40% of the production in order to obtain foreign exchange.

The Michelin company, with a large plant at Clermont-Ferrand, dominates the rubber industry, especially in tire production. There are two other important firms, Goodrich-Colombes and Hutchisson. Michelin has pioneered for years in the use of metal cords for tires. The steel used is a special alloy made by the Michelin company itself. The metal cords are especially effective in truck sizes and under conditions where cutting is not experienced. The tires are often sold on the basis of a guarantee of 30,000 kilometers (about 18,000 miles). Passenger tires with metal cords are being made on a small scale.

The French National Center of Scientific Research conducts research on rubber at the Laboratory of Physical Chemistry of the Faculty of Sciences of Paris under the direction of Professor M. Magat. Professor Magat, who spent the war years at Princeton on synthetic rubber research, supervises the following projects: (1) dielectric studies over a range from five cycles a second to about 10,000 megacycles a second; (2) viscosity and other properties of polymer solutions especially near the precipitation point (Gavoret) [1][3]; (3) chromatographic techniques for the separation of polymer fractions by adsorption (Landler) [2]; (4) polymerization initiated by free radicals originating from slow neutrons (Schapiro)[4]; (5) degradation of polymers in solution, where chain scission is the predominant reaction (Lacau) [3]; and (6) determination of particle sizes and molecular weights by light scattering (Kunst).[4]

The French Rubber Institute has quite varied functions. It includes a documentation center which abstracts articles on rubber and publishes the *Revue Générale du Caoutchouc*. The Institute also conducts two courses of instruction, one in rubber technology for men entering the rubber product industry, and another in plantation practices for those who will be employed on plantations in Indo-China. About a dozen students are now enrolled in each of these courses. The research center, under Jean Le Bras develops test methods and conducts research.

A 10- by 15-inch research mixing mill of particular interest was manufactured by the Troester firm in Hannover, Germany, in 1939. It had an independent motor and drive for each roll. It was stated that temperature equilibrium was attained within a minute after a large change in heat generation at the surface of the rolls. Research on the study of aging by measurement of oxygen absorption has led to the development of equipment for maintaining constant pressure of oxygen by electrolysis which generates oxygen only as fast as it is absorbed. A commercial version of oxygen absorption equipment for comparison testing does not have this feature, and the pressure decreases as the test progresses.

Federal Testing and University Research in Switzerland

The Swiss Government maintains a materials testing laboratory affiliated with its Federal Technical University

[1] This talk, given before the Washington Rubber Group on October 26, 1948, is based on information obtained during a trip to Europe in May, June, and July, 1948.
[2] National Bureau of Standards, Washington, D. C.
[3] Numbers in brackets refer to Bibliography items at the end of this article.
[4] Unpublished work.

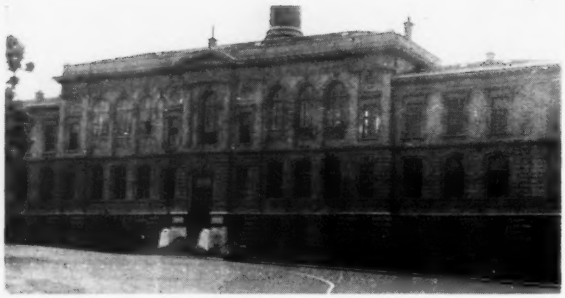

Fig. 1. Chemical Laboratory of the University of Geneva, Switzerland

in Zurich. The work on metals, oils, paints, varnish, and lacquers is much more highly developed than the work on rubbers and plastics, which is just getting under way. The director is P. Schläpfer, a former student of Staudinger, who measured the heat of combustion of rubber about 25 years ago. M. Brunner is in charge of the work relating to rubber. Much interest was shown in tear testing and flex testing.

The first tire factory in Switzerland was put into operation in the Spring of 1948. It is a subsidiary or affiliate of the Firestone company and is located in Altorf.

Prof. Kurt H. Meyer at the University of Geneva is directing experimental work on the thermodynamics of rubber and stress-strain-temperature relations. A. J. van der Wyk has been measuring the torsional stress in rubber rods at different temperatures [4].

Prof. Werner Kuhn at the University of Basle is the author of a large number of papers on the kinetic theory of elasticity of rubber. The experimental work on which some of Professor Kuhn's theories have been based is conducted by Hans Kuhn, who has studied the viscosity and other properties of polymer solutions, and by Othmar Kunzle, who has studied the distribution of mechanical relaxation times. They have found that the molecules of the polymer of methacrylic acid can be extended to almost their full length in solution by placing a charge on them. The viscosity of the solution increases by a factor of 100 to 1,000 because of this extension.

Rubber Research in the Netherlands [5]

The Netherlands Government established an institute for research on rubber in 1910. Since 1941 it has received some industrial support and is known as the Rubber Research Institute T.N.O. (Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, or Organization for Applied Scientific Research) [6]. For many years the director of this institute has been A. van Rossem, who is also a special professor of rubber chemistry and technology at the Technical University in Delft. General research for the Netherlands rubber industry, testing, and advisory services are performed by the Institute. Testing methods for oxygen absorption, for determination of carbon black in rubber, and for plasticity measurements were of special interest.

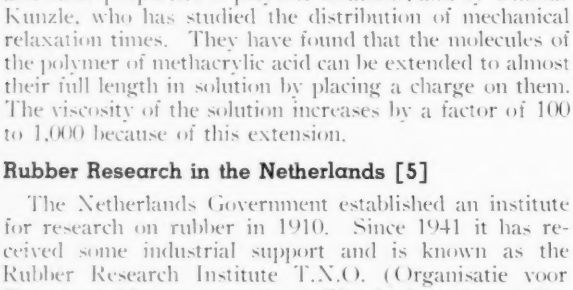

Fig. 2. Rubber Foundation in Delft, Netherlands

The Rubber Foundation [6] in Delft is affiliated with the British Rubber Producers' Research Association and the French Rubber Institute. In the interest of increasing the use of natural rubber, the Foundation conducts research and development and makes technological studies under the direction of R. Houwink. Measurements of the speed of retraction of stretched rubber are made by a device utilizing simple electrical contacts, and stress-temperature studies are also under way. At the technical physics laboratory of the Technical University of Delft the Rubber Foundation is sponsoring X-ray studies of the crystallization of rubber under J. J. Arlmann and dynamic studies under Dr. Bronkhorst.

The permeability of rubbers to different gases has been studied by G. J. van Amerongen, of the Rubber Foundation, for a number of years. His more recent work includes a number of new polymers, including Butyl rubber, and an extension of the temperature range to include observations between 0 and 100° C. Dr. van Amerongen [7] and his colleagues have also investigated the optimum conditions of pyrolysis of rubber. They find that the maximum yield of isoprene is obtained from natural rubber at a temperature of 725° C. and a pressure of 10 mm. of mercury. Many other polymers have been investigated with results generally similar to those obtained by Bond,[4] Wall [8], and Madorsky [9] at the National Bureau of Standards.

The Plastics Institute T.N.O. in Delft, under Dr. Stoutjesdyk, has as chief of its scientific department A. J. Staverman. The Institute has extensive testing facilities. Research on the properties of polymer solutions under dynamic stresses at frequencies between one and 100 c.p.s. was of special interest.

The Fiber Institute T.N.O. in Delft is engaged in a number of investigations relating to the technology of textiles. One of the more unusual of these was a study of the best conditions for breeding clothes moths to be used in testing moth-proofing treatments.

The laboratories of the Royal Dutch-Shell petroleum company are located in Amsterdam. A. J. Wildschut, in charge of high polymer research, had Dr. Rumscheidt of the plastics section describe the development of a new fiber which is a chemical derivative of natural rubber. It is much cheaper than nylon and is regarded as an economic competitor of rayon. It is made by the reaction of a gas with natural rubber. The reaction produces a material which contains no double bonds and which has the same molecular weight distribution as the rubber used. It can be dissolved and precipitated out without apparent change as it is passed through spinnerets. It can be oriented immediately after precipitation. The tensile strength increases with orientation more rapidly than that of viscose rayon. It is easy to obtain fibers with a tensile strength of 2.0 grams per denier. Dyeing with acid dyes is quite satisfactory, and the water absorption is very low. The orientation studies are being conducted by J. M. Goppel by means of X-rays.

At the Shell laboratories studies of second-order transitions in vinyl chloride polymers and copolymers have been conducted by means of dilatometers.

Rubber tire manufacturing in the Netherlands has been initiated on an appreciable scale since the end of the war. The leading company, Vredestein, is an affiliate of The B. F. Goodrich Co.

British Rubber Research and Technology

The outstanding organization for fundamental research on rubber in England is the British Rubber Producers'

Research Association [10] with laboratories in Welwyn Garden City. Receiving its support from an export tax on natural rubber produced in the Far East, the Association might be regarded as semi-governmental. However it is controlled by a board of directors, and the research work is closely coordinated with that of the affiliated laboratories of the French Rubber Institute and the Dutch Rubber Foundation (Rubber Stichting). The present staff includes about 40 university graduates and a corresponding number of assistants. In the 10 years since it was organized the association has published about 100 research papers in scientific journals. Many of these have been of outstanding importance in the basic science of rubber. The form of the organization, the emphasis on fundamental research, and its successful operation appear to be largely due to John Wilson, the first director of research. Mr. Wilson, who resigned in 1947, is now organizing a similar laboratory for the British Rayon Research Association in Manchester.

The present director is Geoffrey Gee, who has specialized in physical chemistry. L. R. G. Treloar is in charge of the work in physics. E. H. Farmer directs the work in organic chemistry, and W. T. Chambers is responsible for that in analytical chemistry. Increased emphasis is being placed on the technology of rubber under Dr. Long and on new applications of rubber under the direction of C. M. Blow. It is felt that there is a real need of work which outlines clearly the detailed application of many of the basic principles described in the hundred papers already published dealing with the fundamental research.

An interesting arrangement being employed by W. P. Fletcher under Dr. Treloar's direction in dynamic studies of rubber compounds utilizes equipment operated from 20 to 80 cycles a second by an electromagnetic driver similar to a loud speaker and permits studies of dynamic shear with superposed static shear and superposed static compression. The dynamic loss, or internal viscosity, appears to be approximately inversely proportional to the 0.8 power of the frequency for pure gum compounds and the 1.0 power for carbon black compounds. Normally good agreement is obtained between the power input and the losses calculated from resonance peaks or from the decrement of free vibrations.

A mechanical prototype of an electronic digital computer is being constructed for some of the more difficult computations required in the problems of X-ray diffraction and Rivlin's theory of high-deformation elasticity. A cam-operated specimen cutter actuated by a hand-driven flywheel seemed to have considerable advantages over the arbor presses commonly used in this country. A two-piece cutting die was shown which will give specimens varying in width from 1/32- to ½-inch, depending on the spacing of the two pieces. A gear shift on mixing mills, noted here and elsewhere in England, permits obtaining either a friction ratio of 1.36 or 1. Consequently a compound can be sheeted out at even speed after having been mixed at the higher ratio.

A. Schallamach is beginning work on a fundamental investigation of abrasion with a related study of friction. An experimental study of crystallization and thermodynamic effects by means of measurements of specific volume is likewise being initiated. Dr. Chambers is concerned with improving the method for the direct determination of oxygen. It was originally desired especially for compounds of low molecular weight used in studies by Dr. Farmer and his group.

The applications group gave an interesting demonstration of Positex, a natural rubber latex in which the charge on the particles is made positive rather than negative by the addition of a cationic soap. Positex readily adheres

Fig. 3. Laboratories of the British Rubber Producers' Research Association in Welwyn Garden City, England

to wool and other fibers which normally bear a negative charge. An extremely thin coating applied in this manner decreases matting and felting very greatly in wool fibers.

The association has maintained very cordial relations with the National Bureau of Standards over a period of years and sent R. S. Rivlin to the Bureau as guest worker for the year 1946-1947.

The Research Association of British Rubber Manufacturers [11], located in Croydon, is one of about 40 trade associations supported jointly by industrial membership fees and government funds. The membership fees, which are graduated according to the capital of the firm, may be equivalent to several thousand dollars a year for the larger organizations. The association maintains a number of activities for the benefit of its members, including information, testing, analysis, trouble-shooting, and research services.

The intelligence division, under T. R. Dawson, maintains a library of more than 71,000 items and a classified reference card index of abstracts containing almost 600,000 items, certainly the most comprehensive index of rubber publications in the world. New abstracts, entitled "Summary of Current Literature," are published monthly as a part of the *Journal of Rubber Research*.

The director of the research laboratory is J. R. Scott, and associated with him are R. G. Newton in charge of physical testing, W. C. Wake in charge of chemical work, especially analysis, and L. Mullins in charge of the work on physics. Over the period of 25 years the laboratory has been in operation it has published a large number of significant contributions to rubber technology, including especially test methods and properties of compounds.

Dr. Scott demonstrated a conical rotor for the Mooney viscometer designed by him to give a virtually constant rate of shear in all portions of the rubber sample [12].

Dr. Wake gave some valuable criticisms of the chemical test methods contained in the American Society for Testing Materials Standards on Rubber Products. The criti-

Fig. 4. Laboratories of the Research Association of British Rubber Manufacturers, Croyden, England

cisms and suggestions have now been communicated to members of the ASTM committee on chemical analysis. Mr. Mullins described some experimental work that leads to the notion of a filler-rubber structure, which is broken down by repeated stretching until the modulus is the same as that of the corresponding pure gum compound [13].

The association recently received from Germany a Roelig dynamic test machine, a large Troester mill, a Defo plastometer, and a new Schopper tensile tester.

Work on the properties and purification of natural rubber, including the different botanical varieties, is conducted at the Imperial Institute in London under the sponsorship of the London Advisory Committee for Rubber Research (Ceylon and Malaya) [14]. The director is G. Martin.

The largest rubber company in England is Dunlop Rubber Co., Ltd., with several different plants. Tire manufacturing is conducted at Fort Dunlop in Birmingham. F. G. W. King is the technical director, and W. C. Davey the chief chemist. A new research laboratory is under construction. Tire testing is conducted with about a dozen endurance wheels of various designs. In the main these were found to be rather similar to those developed at the National Bureau of Standards, 25 years ago. One of the most unusual, however, was operated at 400 miles an hour for testing the tires used in setting the automobile speed records. The treads of these tires are about 0.02-inch thick. Failures in tires driven at these speeds are most likely to arise from failure of the bead wire. Results useful in the construction of airplane tires are also obtained with this machine. The drop test, in which a weighted cone is dropped from successively greater heights, is regarded as much more satisfactory than the plunger test used in the United States for testing carcass strength.

In the chemical laboratories studies of aging by measurement of oxygen absorption were under way. Periodic variations in the rate of oxidation were observed. Efforts were under way to correlate these with the formation and disappearance of peroxides. C. E. Kendall there has devised a system of chemical ciphering for the representation of complex organic compounds by letters and numbers. The system is regarded as having advantages over several others now in use, and a publication [15] describing it has been issued by the Royal Institute of Chemistry of Great Britain and Ireland.

The most significant work on synthetic rubber in England seems to have been done at the laboratory of Imperial Chemical Industries, Ltd., in Manchester. W. J. S. Naunton is in charge of the laboratory, with J. M. Buist responsible for the work on physical testing, J. T. Watts for the equipment for compounding and airing, and Dr. Flint for latex technology.

During the war when synthetic rubbers, especially GR-S, were in use in England, the Ministry of Supply supported an extensive program at the laboratories of Imperial Chemical Industries aimed at furnishing information on the utilization of synthetic rubbers. At present natural rubber is receiving the major emphasis, of course, with studies of test methods and the proper use of compounding ingredients, of which this firm is one of the leading British suppliers.

The results of some of the work in the I.C.I. laboratories during the war are summarized in the book "Rubber in Engineering" [16]. Some of their more important developments in physical test methods include a hardness tester operating at constant deflection, a torsion freeze test, dynamic testing equipment, a cutter for tear tests, and a ring cutter.

The Ministry of Supply maintains in London an Advisory Service on Plastics and Rubber, with G. L. Hammond in charge of the rubber unit. It has been sponsoring work at the Imperial Chemical Industries laboratories in Manchester and at the Research Association of British Rubber Manufacturers in Croydon. In addition to the book "Rubber in Engineering" already mentioned, this work has led to a very valuable series of small publications designated as "Users' Memoranda" and "Manufacturers' Memoranda."

The Northern Polytechnic in London offers a three-year course in rubber technology, probably the only one of its kind in any country [17]. It is planned to expand this into a National College of Rubber Technology. Students are given a number of courses in physics, chemistry, and mathematics in addition to the technological operations. At the conclusion of the course the students are qualified to take the examination leading to an associateship in the Institution of the Rubber Industry. F. H. Cotton is in charge of the course. Opportunities are given to graduate students to undertake research in rubber technology leading to a thesis acceptable by the University of London for a master's or doctor's degree.

International Meetings

Technical Committee 45—Rubber, of the International Organization for Standardization ("I.S.O."), met in London at the British Standards Institution June 28 and 29, with representatives from 10 of the 12 member countries. The discussion centered on the specification of several arbitrary conditions in certain test methods in international use. The tests considered were hardness, tensile strength, abrasion, and tear strength. Agreement was reached on several points for recommendations to the respective national organizations. Few of the recommendations differed appreciably from current American practice, with the exception of the recommended temperature of test, which was set at 20° C. in conformity with usual laboratory temperatures in Europe.

The Second International Rubber Technology Conference, sponsored by the Institution of the Rubber Industry, held in London, June 23-25, was attended by more than 500 participants, more than 100 of them from outside England. About 20 members each came from France, Netherlands, and the United States, with smaller delegations from the other countries. In all about 23 countries were represented. Forty-three technical papers covered a wide variety of topics. The papers will be published in book form as the "Proceedings of the Rubber Technology Conference London 1948."[5]

The technical sessions were conducted under the subjects of synthetic rubbers, chemistry of rubber, physics of rubber, testing and analysis, compounding ingredients, carbon black, and factory processes.

The conference furnished a most valuable opportunity to make contacts with foreign research workers in rubber and to review the progress in rubber technology since the previous conference in 1938.

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[11] "Variation of the Viscosity of Solutions of GR-S with the Temperature and with the Solvent." G. Gavoret, M. Magat, *J. chim. phys.*, 44, 90 (1947).

[12] "Chromatographic Fractionation of Some Synthetic Elastomers." I. Lanclee, *Rubber Chem. Techn.*, 21, 682 (1948).

[13] "Degradation of High Polymers." J. Lacau, *Compt. rend.*, 224, 917 (1947).

[14] "The Thermoelastic Properties of Rubber." K. H. Meyer, A. J. A. van der Wyk, *Rubber Chem. Techn.*, 21, 314 (1948).

[15] "Rubber Science and Technology." A. van Rossem. Part IX of "Chemistry in Wartime in the Netherlands." Published under the auspices of the Netherlands Chemical Society, Amsterdam, 1947.

(*Continued on page 198*)

[5] Several of these papers have been and will be published in India RUBBER WORLD

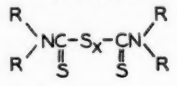
Ultra-Accelerators in GR-S [1]

G. M. Wolf[2] and C. C. de Hilster[2]

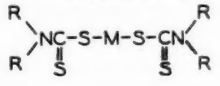
THE ultra-accelerators are an important class of organic compounds, affording the rubber technologist a set of versatile tools. These materials, introduced some 30 years ago, were originally employed in stocks requiring a fast cure at low temperature. Since that time their use has been advantageously extended to nearly every type of rubber compound. The wide usage of synthetic rubber in the past six years has created an increasing demand for this class of accelerators.

Although numerous accelerators fall into the ultra class, this paper is limited to the tetraalkylthiuram sulfides and the metal dialkyldithiocarbamates. These two types of vulcanization accelerators are well known since they have been used commercially for many years. Rubber compounding studies of these ultra-accelerators have been confined, with the exception of a few butyl derivatives, to the methyl and ethyl compounds. To the authors' knowledge no complete rubber compounding survey of an homologous series of accelerators of these types has been reported in the literature. Therefore tetramethyl, tetraethyl, tetra-*n*-propyl, tetra-*n*-butyl, and tetra-*n*-amylthiuram mono- and disulfides, and the lead, zinc, selenium, and copper salts of the corresponding dialkyldithiocarbamic acids were prepared. All of these products have been studied as primary and as secondary accelerators in GR-S. The tetraalkylthiuram disulfides and selenium dialkyldithiocarbamates have also been studied as vulcanizing agents. Some of their more pertinent physical properties are listed in Table 1.

TETRAALKYLTHIURAM SULFIDES



METAL DIALKYLDITHIOCARBAMATES



R = ALKYL X = 1, 2, 3, ETC. M = METAL

TABLE 1. PHYSICAL PROPERTIES OF TETRAALKYLTHIURAM SULFIDES AND METAL DIALKYLDITHIOCARBAMATES

Alkyl Radical	Color and Appearance	Molecular Weight	Specific Gravity at 20° C.	Melting Point °C.
Group I. Tetraalkylthiuram Sulfides				
Monosulfides				
Methyl	Light yellow powder	208.35	1.39	107
Ethyl	Brown liquid	264.44	1.13	28.5–29.8
n-Propyl	Brown liquid	320.55	1.04	...
n-Butyl	Dark red liquid	376.66	0.99	...
n-Amyl	Deep red liquid	432.76	0.96	...
Disulfides				
Methyl	White powder	240.41	1.29	146–148
Ethyl	Cream powder	296.51	1.17	65–70
n-Propyl	Light yellow powder	352.61	1.09	49.5–50.5
n-Butyl	Dark red liquid	408.72	1.03	...
n-Amyl	Dark red liquid	464.82	0.99	...
Group II. Metal Dialkyldithiocarbamates				
Lead				
Methyl	Light grey powder	447.62	2.38	320–323
Ethyl	Light grey powder	503.72	1.87	206–207
n-Propyl	Grey brown powder	559.82	1.65	97–98
n-Butyl	Light cream powder	615.93	1.42	72–73
n-Amyl	Light yellow liquid	672.03	1.40	...
Zinc				
Methyl	White powder	305.79	1.65	248–250
Ethyl	White powder	361.89	1.47	174–180
n-Propyl	White powder	417.99	1.35	107–108
n-Butyl	White powder	474.10	1.24	105–108
n-Amyl	Cream powder	530.20	1.14	65.5
Selenium				
Methyl	Yellow powder	559.78	1.57	146
Ethyl	Deep yellow powder	671.98	1.32	62–86
n-Propyl	Orange powder	784.18	1.23	15
n-Butyl	Dark red liquid	896.38	1.11	...
n-Amyl	Dark red liquid	1008.60	1.03	...
Copper				
Methyl	Light brown powder	303.98	1.70	360
Ethyl	Dark brown powder	360.08	1.49	196–197
n-Propyl	Black powder	416.18	1.24	100–101
n-Butyl	Black powder	472.29	1.26	77–78
n-Amyl	Black powder	528.39	1.15	50

In each of the six groups of accelerators listed the methyl through the *n*-amyl derivatives conform to the orderly pattern of an homologous series. As the molecular weight increases, the color darkens, and the specific gravity and melting point decrease. In fact the higher members of several series are so low melting that they are liquids at room temperature. The physical properties of the members of an homologous series are frequently indicative of their relative utility as accelerators for specific purposes. Thus such important properties as accelerator activity, ease of dispersibility, ease of incorporation, and solubility are directly related to the molecular weight and melting point in these series of compounds.

This study was conducted primarily to determine the effect on rate of cure and physical properties of the resulting vulcanizates when the five lower members of each series were employed as accelerators. At the same time comparisons of physical properties could be made among the members of all series.

The authors, as a result of Vila's[3] work and their own preliminary investigations, concluded that a study of accelerator-sulfur ratios was not necessary for each accelerator of an homologous series in order to establish differences or trends in physical properties of the vulcanizates. Vila has established the optimum ratio of tetramethylthiuram mono- and disulfide and zinc dimethyldithiocarbamate for a GR-S stock containing 50 parts of EPC black and two parts of sulfur. Further work by Vila also showed what quantities of tetramethylthiuram monosulfide should be employed at various sulfur levels to obtain balanced compounds. From these results the present authors consider a sulfur content of 1.5 parts with 0.4-part of an ultra-accelerator to be desirable for the type of compound which is under study.

Zinc dibutyldithiocarbamate and the lower members (methyl and ethyl derivatives) of each series are the accelerators usually available commercially. The selected accelerator-sulfur ratio for the lower members was retained for the higher members in order to establish differences in accelerator activity. Strictly speaking, each accelerator should be judged according to its own individual sulfur accelerator ratio. In view of the foregoing discussion, however, it is believed that the same relative order of accelerator activity should apply generally, regardless of the accelerator-sulfur ratio.

Another approach to the same problem was made in the case of the tetraalkylthiuram disulfides by incorporating the accelerators on a "molecular weight basis" and noting the differences in rate of cure and physical properties of the vulcanizates. This approach will be discussed later.

Based on Vila's investigation, three parts of tetramethylthiuram disulfide were chosen as an optimum amount to employ as a vulcanizing agent. Concentrations in excess of this amount exhibit trends typical of over-acceleration.

[1] Presented before the Division of Rubber Chemistry, A. C. S., Los Angeles, Calif., July 23, 1948.

[2] Sharples Chemicals, Inc., Wyandotte, Mich.

[3] *Ind. Eng. Chem.*, 34, 1269 (1942).

Experimental Procedure

For evaluation of these ultra-accelerators in GR-S the following formulae were employed.

	As Primary Accelerator	As Secondary Accelerator	As Vulcanizing Agent
GR-S	100	100	100
Coal-tar softener	5	5	5
Zinc oxide	5	5	5
EPC black	50	50	50
Sulfur	1.5	1.5	
Benzothiazyl disulfide		1.5	1.0
Ultra-accelerator	0.4	0.15	3.0

All compounds were mixed on an open six- by twelve-inch laboratory mill with the initial roll temperatures constant for each run. In order to maintain the variables at a minimum, each batch was mixed according to a definite milling procedure; mixing time and order and rate of addition of the compounding ingredients were the same in all experiments. All stocks were allowed to rest 24 hours, then refined by two passes through a tight mill, and sheeted to the desired thickness before curing.

The following physical testing procedures were employed throughout:

STRESS-STRAIN MEASUREMENTS. Modulus, tensile strength, and elongation at break were determined on a Scott machine according to A.S.T.M. Standards on Rubber Products D412-41 (1944). The air oven method of accelerated aging, D573-42, was followed, using an operating temperature of 212° F. for 72 hours.

HARDNESS. A Shore durometer, Type A, was used to measure hardness according to A.S.T.M. designation D676-42T on tensile slab specimens piled three high. All readings were instantaneous.

TEAR RESISTANCE. Die B specimens cut from a standard tensile slab were employed according to A.S.T.M. procedure D624-41T.

PERMANENT SET. Per cent. "breaking set" was determined on tensile specimens measured five minutes after rupture.

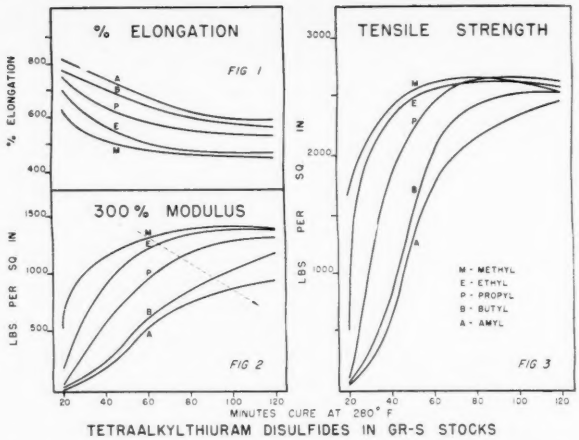
RESILIENCE. Rebound measurements were made on the Lüpke resiliometer, using a cylindrical disk specimen, 1.129 inches in diameter and 0.5-inch in thickness.

COMPRESSION SET. A.S.T.M. procedure D395-40T, method B, using a standard test specimen molded to the required size and deflected 30%, was employed for this test.

HEAT BUILD-UP. The temperature rise ($\triangle$T) above 212° F. was determined on the Goodrich flexometer according to A.S.T.M. designation D623-41T, Method A. Pellets 0.7-inch in diameter and 1.0-inch in height were molded to size and flexed under a load of 143 pounds per square inch with a stroke of 0.175-inch. Specimens were preheated one hour at 212° F. before testing, and the flexing was continued to a constant temperature of at least three consecutive readings of one-minute interval.

Selection of Optimum Cure of Physical Properties

A range of cure times of 20, 40, 60, 80, and 120 minutes at 280° F., and 5, 10, 15, 20, and 30 minutes at 316° F. were chosen for this study. A method employed by Garvey and Freese[1] for selecting optimum cure in a comparison of carbon black groups in a GR-S compound was chosen for this work. A selected cure which was considered optimum for each accelerator formulation was chosen from modulus-time of cure curves. The selected cure time is that at which a sharp change occurs in the modulus-cure curve. The selection of optimum cure is shown by a line drawn through the 300% modulus-time of cure curves (Figure 2) for the methyl through the



Figs. 1, 2, 3. Elongation, Modulus at 300%, and Tensile Strength for the Tetramethyl, Tetraethyl, Tetra-*n*-Propyl, Tetra-*n*-Butyl, and Tetra-*n*-Amylthiuram Disulfides as Primary Accelerators in GR-S

n-amyl derivatives. Modulus values corresponding to the selected cures were read directly from the modulus-time of cure curves by inspection. The higher members of the accelerator series studied produce less vigorous acceleration resulting in a gradual inflection of the modulus-cure curve. In these cases this method of selecting optimum cure is less satisfactory, and for the extreme cases an undercure may be chosen. Regardless of whether this method of selecting optimum cure, or the commonly employed criterion based on maximum tensile strength is employed, the order of accelerator activity within a series is the same. In the case of tensile strength, elongation, hardness, resistance to tear, and breaking set, additional curing curves were plotted, from which similar values were also read by inspection.

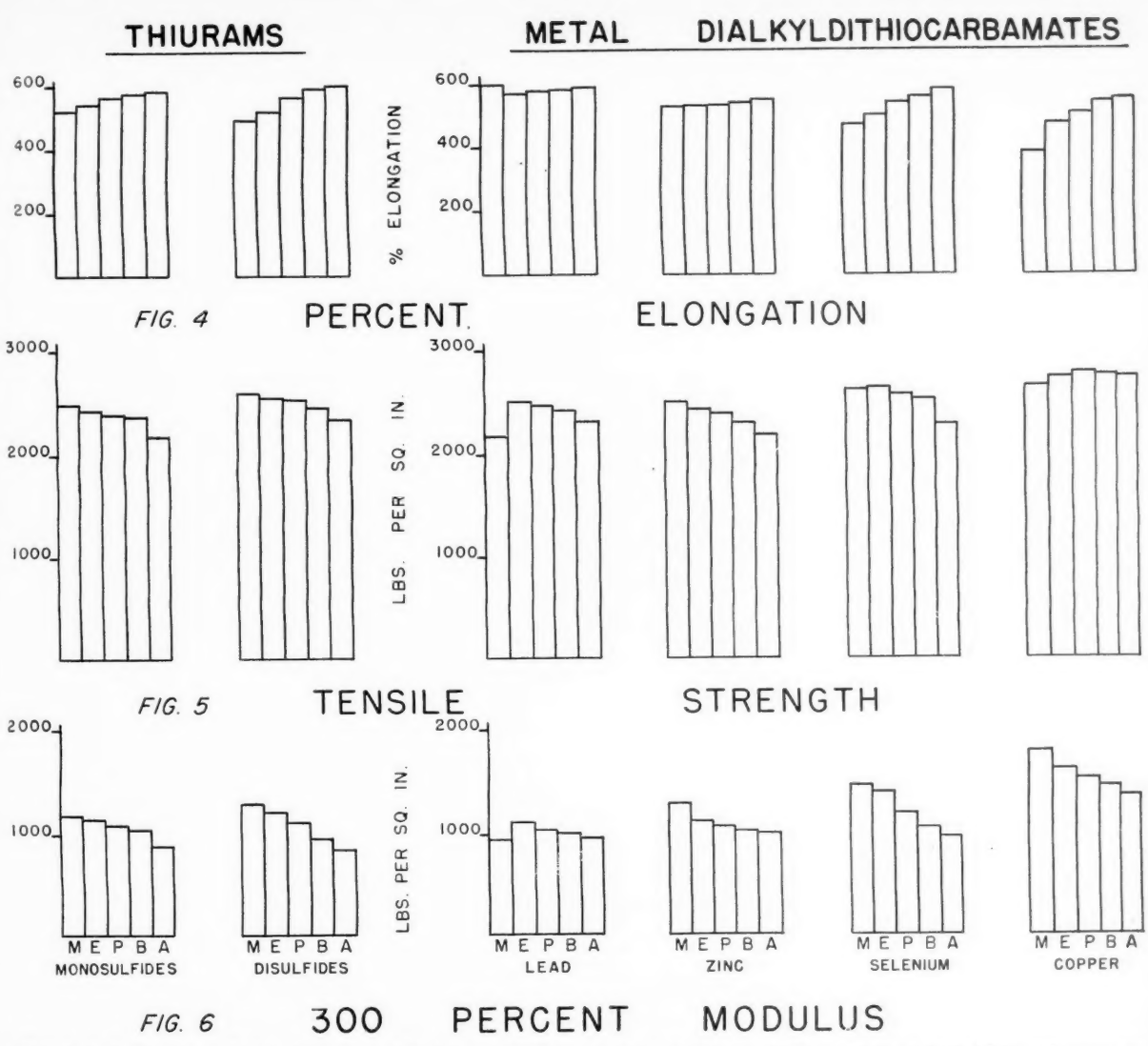
The specimens employed for resilience, compression set, and hysteresis were cured 80, 100, and 120 minutes at 280° F. The data reported are the average values for the last two cures. By selecting the same cure time for all the accelerators, a few of the specimens were undercured, and some overcured. Here again, the order of potency of the accelerators within a series would not be altered even though a different method of selecting cure was employed.

Ultra-Accelerators as Primaries

When the ultra-accelerators are employed as primaries on an "equal weight basis," trends in the physical properties of the vulcanizates of an homologous series are clearly demonstrated. In order to illustrate the effect of time of cure, particularly with respect to stress-strain properties, data for the tetraalkylthiuram disulfides are shown graphically in Figures 1, 2, and 3. An examination of these curves illustrates the slower rate of cure progressing stepwise from the lower to the higher members of the series. The elongation (Figure 1) increases with increasing size of the alkyl group. The optimum tensile strengths (Figure 3) for the derivatives of the tetraalkylthiuram disulfides are quite comparable, even though longer cure times are required for each progressive member of the homologous series. For the same selected cures the modulus decreases (Figure 2) in the order of methyl to *n*-amyl.

The other physical properties of the tetraalkylthiuram disulfides are illustrated by the bar graphs. The breaking

[1] Unpublished work. See memorandum from H. E. Simmons, ORR, WPB, Washington, D. C. (Aug. 7, 1943).



Figs. 4, 5, 6. Elongation, Tensile Strength, and Modulus at 300% for the Tetraalkylthiuram Sulfides and Metal Dialkyldithiocarbamates as Primary Accelerators in GR-S; Optimum Cure at 280° F.

set (Figure 9) increases with an increasing number of carbon atoms in the alkyl group. Considering the physical testing procedure employed, the hardness values (Figure 7) are comparable and within the limits of experimental error. Likewise, values of resilience (Figure 10), as determined by the Lüpke method, are similar for all members of the series. Based on the average value of the same two cures for each accelerator, the compression set (Figure 11) increases from the methyl to the *n*-amyl derivatives. The value for heat build-up (Figure 12) is at a minimum for the ethyl derivative and shows a rise for succeeding members of the series. The relatively high values noted for the *n*-butyl and *n*-amyl derivatives may result as a condition of undercure caused by accelerator starvation.

By compounding the tetraalkylthiuram disulfides on a "molecular weight basis" as illustrated in Table 2, all of the members of the homologous series reach an optimum cure in 60 minutes. The corresponding values of the physical properties shown are within the limits of experimental error. In fact, if the values were shown graphically with respect to cure time, there would be difficulty in distinguishing the curves represented by the various alkyl groups. Therefore on a "molecular weight basis," at least in the case of the tetraalkylthiuram disulfides, the accelerator activity and physical properties of the vulcanizates are the same for all members of the homologous series. The higher members appear to be less scorchy, since the initial rate of cure is slower.

The accelerators of the other five homologous series were compared and evaluated on an equal weight basis in a manner similar to that described for the tetraalkylthiuram disulfides. The optimum cures selected from 300% modulus-time of cure curves for tensile properties appear in Table 3.

In each homologous series the same general pattern of change in physical properties is observed as outlined for the tetraalkylthiuram sulfides (Figures 4-12). The lead dialkyldithiocarbamates constitute an exception to this rule, in which case the ethyl derivative is faster curing as shown by a lower elongation (Figure 4) and a higher 300% modulus (Figure 6) and tensile strength (Figure 5). Consequently, in this series the trends discussed previously stem from the ethyl accelerator.

In the majority of cases the differences in values for

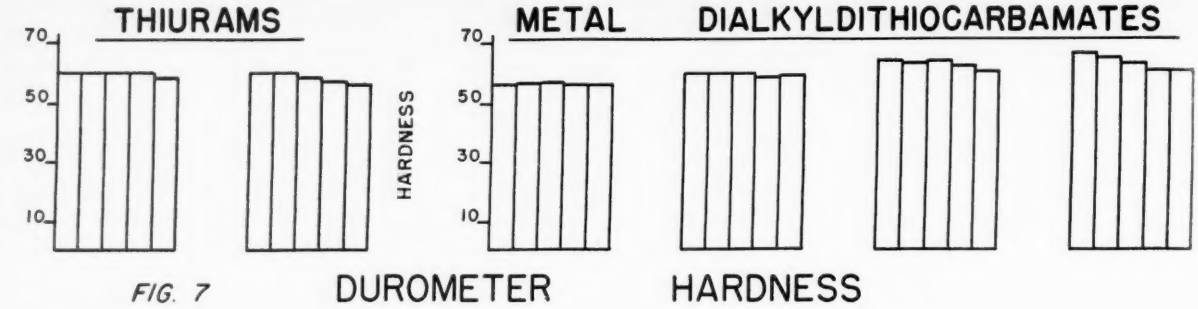


FIG. 7 DUROMETER HARDNESS

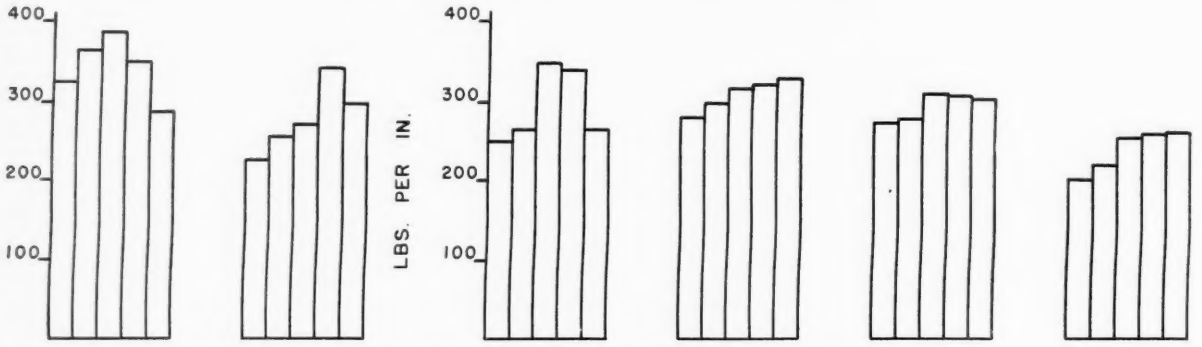


FIG. 8 TEAR RESISTANCE

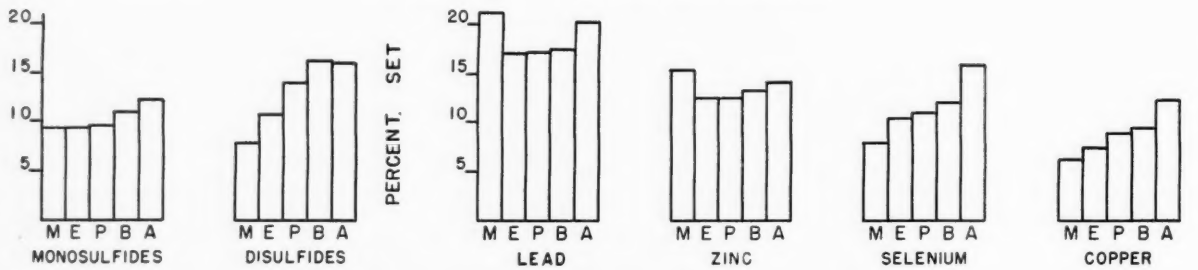


FIG. 9 PERCENT BREAKING SET

Figs. 7, 8, 9. Durometer Hardness, Tear Resistance, and Breaking Set for the Tetraalkylthiuram Sulfides and Metal Dialkyldithiocarbamates as Primary Accelerators in GR-S; Optimum Cure at 280° F.

TABLE 2. COMPARISON OF TETRAMETHYL, ETHYL, *n*-PROPYL, *n*-BUTYL, AND *n*-AMYL THIURAM DISULFIDES ON A MOLECULAR WEIGHT BASIS AS PRIMARY ACCELERATORS IN GR-S

Alkyl Radical	Parts of Accelerator	Cure in Minutes at 280°F.	Modulus 300% P. S. I.	Tensile Strength P. S. I.	Elongation %	Hardness Shore
Methyl	0.4*	20	430	1840	810	54
		40	910	2900	660	59
		60	1100	3140	630	60
		80	1110	3200	680	61
		120	1210	3000	580	61
Ethyl	0.493	20	290	1380	910	51
		40	930	3000	680	59
		60	1150	3010	600	60
		80	1160	2990	520	61
		120	1300	2850	540	62
n-Propyl	0.58	20	140	640	980	46
		40	840	2900	700	57
		60	1140	3170	630	60
		80	1140	3200	600	60
		120	1290	3200	560	62
n-Butyl	0.68	20	90	200	980	44
		40	750	2730	710	59
		60	1040	3090	650	59
		80	1150	3170	610	60
		120	1250	3110	570	61
n-Amyl	0.77	20	100	370	900	45
		40	790	2650	690	56
		60	1000	2950	640	59
		80	1100	2880	590	60
		120	1200	2950	560	61

*The numerical data reported for vulcanizates produced with the aid of 0.4-part of tetramethylthiuram disulfide are not in agreement with the corresponding data in Figures 1, 2, and 3. A different lot of an improved GR-S was employed in obtaining the results shown in Table 2.

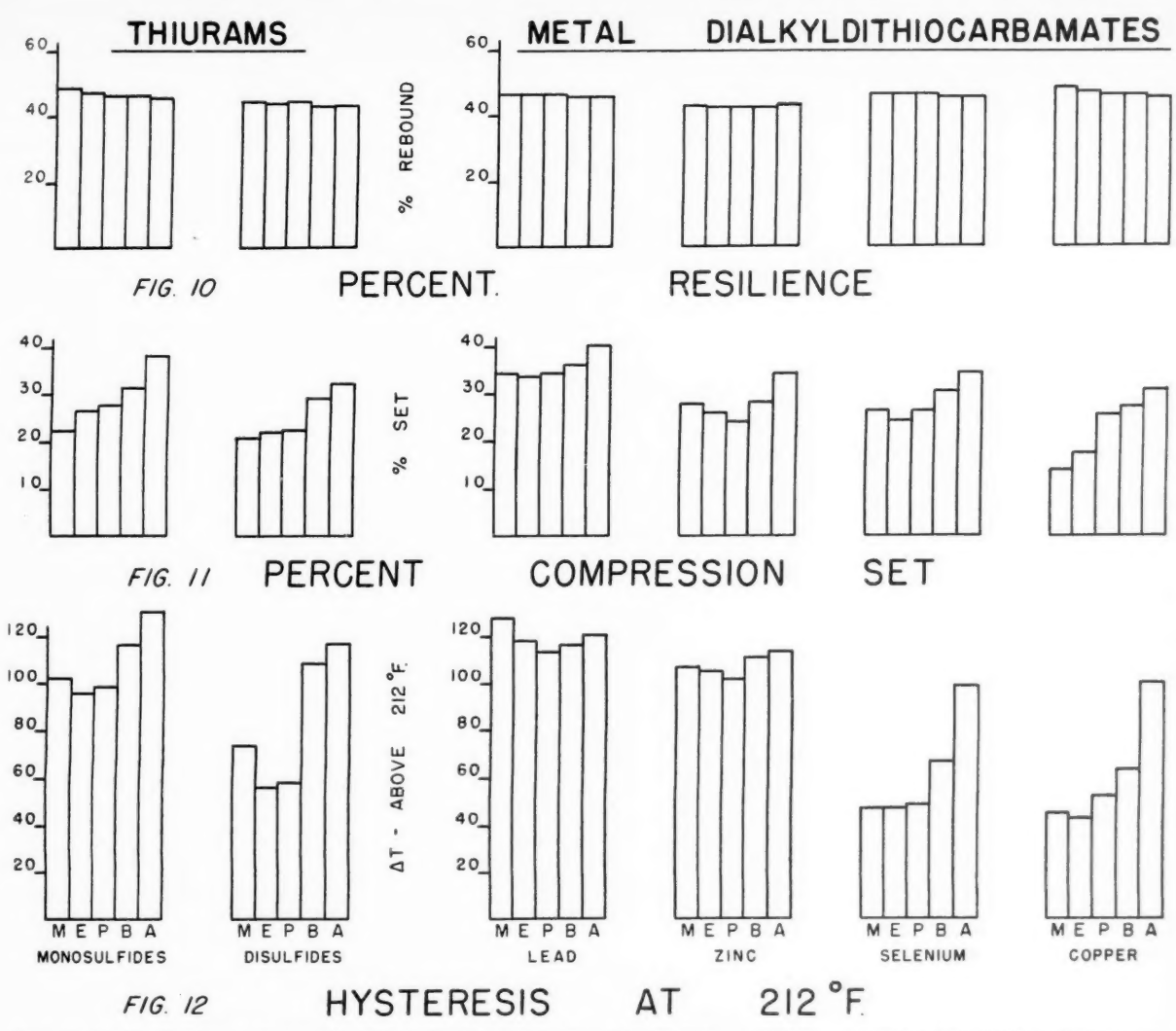
TABLE 3. SELECTED CURING TIME FOR TENSILE, HARDNESS AND TEAR RESISTANCE PROPERTIES FOR THE ULTRAS AS PRIMARIES

(Minutes Cure at 280° F.)

	Tetraalkylthiuram Sulfides		Metal Dialkyldithiocarbamates			
Alkyl Radical	Mono	Di	Lead	Zinc	Selenium	Copper
Methyl	60	60	80	60	60	40
Ethyl	68	63	80	74	62	49
n-Propyl	80	76	96	86	70	53
n-Butyl	103	92	117	109	76	57
n-Amyl	120	100	120	120	80	60

each physical property are not of great magnitude between the homologs of a series, although upward or downward trends are discernible.

Undoubtedly these trends result from the state of cure, which is a reflection of the activity of the accelerators. Verification of this statement is found in the decrease in hardness and resilience, and an increase in permanent set, compression set, and heat build-up with increasing molecular weight. The latter property exhibits a minimum for the ethyl derivatives except in the case of the lead and the zinc dialkyldithiocarbamates where a minimum



Figs. 10, 11, 12. Resilience, Compression Set, and Hysteresis for the Tetraalkylthiuram Sulfides and Metal Dialkyldithiocarbamates as Primary Accelerators in GR-S; Optimum Cure at 280° F.

occurs with the propyl derivatives. In the case of the lead dialkyldithiocarbamates a plausible explanation of this exception is offered. The minimum heat build-up occurs in the propyl derivative, which is one member higher in the series than the fastest curing member of the series, lead diethyldithiocarbamate. In most cases where great differences do occur, a state of undercure exists for the higher members of the series.

Maximum tear resistance is usually reached at a shorter cure time than that for optimum tensile strength. Since maximum tear resistance for any one stock is the peak value of an elliptical curve which is dependent on cure time, the values of tear resistance for the members of an homologous series at a selected cure time would not necessarily follow a uniform pattern.

Considering the two types of ultra-accelerators which were investigated, the monosulfides are less active than the disulfides in the case of the tetraalkylthiurams. This fact is to be expected, and could have been predicted, since the disulfides not only contain more sulfur than the corresponding monosulfides, but they have sulfur in a form available for vulcanization, a characteristic which the monosulfides do not possess.

In the case of the metal dialkyldithiocarbamates, the order of increasing accelerator activity is lead, zinc, selenium and copper salts.

If all the different types of compounds are considered, the copper dialkyldithiocarbamates are the fastest curing, followed by the selenium salts, the tetraalkylthiuram di- and monosulfides, and the zinc and lead dialkyldithiocarbamates, as illustrated by the selected curing periods listed in Table 3.

In many cases the ethyl homologs may be employed with distinct advantage. They are lower melting (Table 1) than the corresponding methyl compounds and consequently are more readily incorporated in the rubber. Formulations containing the ethyl derivative exhibit a lower modulus (Figure 2) and tensile strength (Figure 3) in the initial cures than do similar formulations containing the corresponding methyl derivative. This condition exists for comparisons on a "molecular weight basis" (Table 2) as well as an "equal weight basis." These results plainly denote that the ethyl derivatives are safer in processing, less scorchy, and afford greater freedom from bin cure than do the corresponding methyl compounds without an appreciable sacrifice in physical properties. Although examples are shown only for the tetraalkylthiuram disulfides, the methyl and ethyl derivatives of the other series usually follow a similar pattern.

For convenience, the values of the physical properties

of all the vulcanizates cured with the methyl and ethyl derivatives, as shown graphically in Figures 4-12, are listed in Table 4. In every case, except the lead dialkyldithiocarbamates, a slight extension of cure time for the ethyl derivatives has resulted in physical properties which are very similar to those given by the corresponding methyl derivative.

Ultra-Accelerators as Secondaries

When the ultra-accelerators are employed as secondaries with mercaptobenzothiazole-type accelerators, the difference in physical properties of the vulcanizates in any one homologous series is within the limits of experimental error. Therefore the various members in the homologous series, when employed as secondaries, may be interchanged with little effect on the vulcanizates. Differences between one homologous series and another are observed, and these differences are in the same order as for the primaries. However the differences resulting between corresponding members of the several homologous series are not nearly so pronounced when the accelerators are used as secondaries as when they are employed as primaries. In Table 5 the results are tabulated for these accelerators as secondaries. A comparison of these values with those plotted in Figures 4-12 indicate very similar patterns. The time of cure chosen for each series was at or near the optimum cure. Here again the tetraalkylthiuram disulfides exhibit a stronger accelerating effect than the corresponding monosulfides. The order of increasing accelerator activity for the metal salts continues to be lead, zinc, selenium, and copper.

Ultra-Accelerators as Vulcanizing Agents

A portion of the sulfur present in the tetraalkylthiuram disulfides and the selenium dialkyldithiocarbamates is available for vulcanization. In the case of tetraalkylthiuram disulfides, one of the four sulfur atoms of the molecule, presumably the sulfur atom shown parenthetically,

TABLE 4. COMPARISON OF PHYSICAL PROPERTIES OF THE METHYL AND ETHYL ULTRA-ACCELERATORS AS PRIMARIES IN GR-S

	Selected Optimum Cure at 280° F.		Modulus, 300% P. S. I.		Tensile Strength, P. S. I.		Elongation %		Durometer Hardness	
	Methyl	Ethyl	Methyl	Ethyl	Methyl	Ethyl	Methyl	Ethyl	Methyl	Ethyl
Tetraalkylthiuram Sulfides										
Mono-	60	68	1200	1160	2500	2460	520	510	60	60
Di-	60	63	1310	1230	2600	2570	490	500	60	60
Metal Dialkyldithiocarbamates										
Lead	80	80	950	1120	2190	2520	600	570	56	58
Zinc	60	74	1300	1125	2510	2430	530	530	60	60
Selenium	60	62	1460	1400	2620	2680	470	500	64	63
Copper	40	40	1810	1620	2070	2730	380	470	67	65

	Tear Resistance, Lbs. In.		Breaking Set, %		Rebound Lüpke,*		Compression Set, %*		Hysteresis, ΔT above 212° F.*	
	Methyl	Ethyl	Methyl	Ethyl	Methyl	Ethyl	Methyl	Ethyl	Methyl	Ethyl
Tetraalkylthiuram Sulfides										
Mono-	327	365	9.4	9.4	48.5	47	22.3	26.8	102	95
Di-	225	257	7.8	11.0	43.8	43.5	20.9	22.1	72	56
Metal Dialkyldithiocarbamates										
Lead	250	264	21.9	17.2	46.5	46.5	34.6	34.0	128	118
Zinc	278	292	15.6	12.5	42.5	42.2	28.0	26.0	107	106
Selenium	270	273	7.8	10.7	46	46.5	25.6	24.2	47	42
Copper	200	220	6.3	7.5	48	47	14.1	17.7	45	41

*Average of 100- and 120-minute cure at 280° F.

TABLE 5. ULTRA-ACCELERATORS AS SECONDARIES WITH BIS-2, 2'-BENZOTHIAZYL DISULFIDE

	Optimum Cure at 280° F. Min.	Modulus 300% P. S. I.	Tensile Strength P. S. I.	Elongation %	Hardness Shore	Tear Resistance Lbs. In.	Permanent Set, %	Compression Set, %*	Resilience Lüpke, %*	Heat Build-up ΔT °F.*
				Group I—Tetraalkylthiuram Sulfides						
Monosulfides										
Methyl	120	1260	2700	530	61	288	12.5	25.5	44.5	57
Ethyl	120	1270	2780	500	60	370	10.9	24.3	44	57
n-Propyl	120	1370	2700	470	60	337	7.8	26.1	45	54
n-Butyl	120	1300	2830	540	60	330	7.8	26.1	45	55
n-Amyl	120	1200	2630	530	60	320	7.8	26.4	44.5	61
Disulfides										
Methyl	100	1170	2510	540	59	280	9.4	17.9	44	55
Ethyl	100	1240	2520	550	58	328	10.5	19.7	43.9	54
n-Propyl	100	1120	2610	550	58	291	11.7	18.3	44	53
n-Butyl	100	1250	2620	550	59	290	10.1	22.0	43.2	59
n-Amyl	100	1230	2320	540	57	290	9.4	22.2	43.8	56
				Group II—Metal Dialkyldithiocarbamates						
Lead										
Methyl	120	1490	2700	480	60	247	9.4	21.3	45	68
Ethyl	120	1460	2720	500	60	245	10.9	21.3	45	61
n-Propyl	120	1370	2670	500	60	208	9.4	22.5	45	62
n-Butyl	120	1250	2620	510	60	206	10.9	22.9	45	57
n-Amyl	120	1210	2630	520	60	254	10.9	24.5	45	65
Zinc										
Methyl	100	1250	2680	580	61	334	9.4	23.3	47	54
Ethyl	100	1110	2510	560	60	332	9.4	22.1	47.3	62
n-Propyl	100	1110	2560	580	60	329	7.8	22.6	46.5	55
n-Butyl	100	1050	2520	570	60	265	6.3	21.3	45	66
n-Amyl	100	1080	2550	580	60	258	9.4	22.4	45	62
Selenium										
Methyl	80	1080	2580	590	63	382	9.3	25.7	45.5	57
Ethyl	80	1060	2630	590	61	375	9.3	24.6	45	50
n-Propyl	80	980	2430	600	62	360	9.3	26.4	45.5	61
n-Butyl	80	920	2320	580	60	365	9.3	26.0	44	61
n-Amyl	80	920	2360	600	59	374	9.3	25.3	44.5	57
Copper										
Methyl	40	1270	2900	540	61	259	9.4	12.4	48.5	40
Ethyl	40	1270	2900	550	60	261	7.8	16.1	47.5	37
n-Propyl	40	1270	2930	570	58	280	12.5	16.9	47	42
n-Butyl	40	1250	2750	550	59	287	12.4	16.2	46.5	40
n-Amyl	40	1160	2700	570	60	270	10.9	17.4	46.5	46

*Average of 100- and 120-minute cure at 280° F.

$$R_2NC(=S)-S-CXR_2$$

is so labile that upon heating it becomes available for vulcanization. Although both sulfur and selenium are considered to be available for vulcanization in the selenium dialkyldithiocarbamates, the equivalent of three sulfur atoms is employed for the purpose of calculating active sulfur content.

When the ultra-accelerators which exhibit this type of vulcanization are compounded without pigment sulfur being present, vulcanizates possessing improved aging properties are obtained. A comparison of members of these two homologous series as vulcanizing agents is illustrated in Figures 13 and 14. Based on modulus-time of cure curves or maximum tensile, a cure time of 60 minutes is an optimum or very nearly an optimum cure in each case. A cure time of 60 minutes at 280° F. was chosen as the basis of comparison for the stress-strain (Figure 13), hardness (Figure 13), breaking set (Figure 14), and tear resistance properties (Figure 14). Compression set (Figure 14) and hysteresis values (Figure 14) were based on vulcanizates cured at 80 minutes at 280° F. The same general trends for an homologous series mentioned in the case of the primary accelerators is shown here, but to a much more marked degree, particularly for the higher members of the series. The selenium salts are definitely faster curing vulcanizing agents than are the corresponding tetraalkylthiuram disulfides. The small change in the stress-strain properties after severe air oven aging for 72 hours at 212° F. is characteristic of this type of vulcanizate. The ethyl derivatives, because of their relatively low melting range, are rapidly and easily dispersed in the rubber at processing temperatures, a fact which results in uniform vulcanization. Consequently the ethyl derivatives have been advantageously employed as vulcanizing agents in certain mechanical goods stocks and in the wire and cable industry; here a rapid and uniform vulcanizate of superior aging properties is required without appreciable sacrifice in original physical properties as compared to the corresponding methyl derivative.

Aging

From other work conducted in our laboratories, but not reported in this paper, several interesting observations on the aging characteristics and the effect of curing temperature on the physical properties of the vulcanizates were noted.

The aging characteristics of the vulcanizates cured with the accelerators listed in Table I were investigated when the accelerators were employed as primaries, as secondaries, and as vulcanizing agents. The accelerated aging tests were conducted in an air oven for 72 hours at 212° F. for the vulcanizates cured at both 280 and 316° F. No significant differences were observed, and variations in aging among vulcanizates prepared from the accelerators of any one homologous series are comparatively small.

There appeared to be little variation in the aging results when the same accelerators were employed as primaries or as secondaries. However, for the same aging period, those accelerators employed as vulcanizing agents led to superior aging results.

Effect of Curing Temperature on Physical Properties

In each homologous series a similar set of stress-strain data was plotted at 316° F. as was followed at 280° F. It is generally accepted that an increase of 18° F. in the curing temperature will produce GR-S vulcanizates with almost identical physical properties in one-half the cure time. This fact was verified quite well in this study of 70 stocks cured at the two temperatures mentioned above.

Generally speaking, the ultra-accelerators, when employed as primaries or as vulcanizing agents, are slightly slower curing at 280° F. than at 316° F.; however, the ultimate physical properties of the vulcanizates are nearly identical for both curing temperatures. In nearly all of the homologous series a slightly lower modulus was observed for the vulcanizates cured at 316° F. as compared to the same vulcanizates cured at 280° F. As secondary accelerators, the ultras exhibited a slightly faster rate of cure at 316° F. than at 280° F., with the physical properties at the optimum cure being comparable for the same formulations vulcanized at the two curing temperatures. No significant differences in aging characteristics were observed for the same stocks vulcanized at the two curing temperatures.

Summary and Conclusions

An homologous series tetraalkylthiuram sulfides and

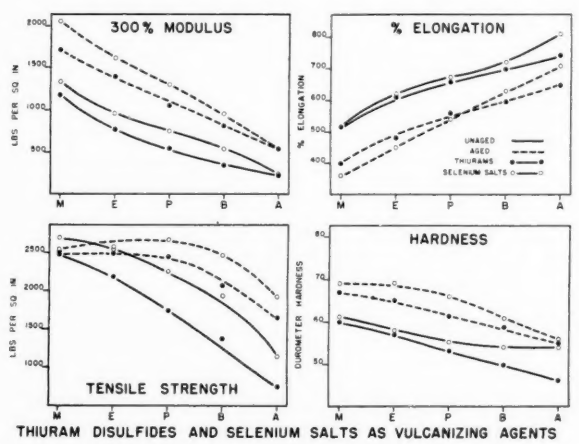


Fig. 13. Modulus at 300%, Elongation, Tensile Strength, and Durometer Hardness for the Tetramethyl, Tetraethyl, Tetra-*n*-Propyl, Tetra-*n*-Butyl, and Tetra-*n*-Amylthiuram Disulfides and the Selenium Salts of the Corresponding Dialkyldithiocarbamic Acids as Vulcanizing Agents in GR-S: Cures—60 Minutes at 280° F.

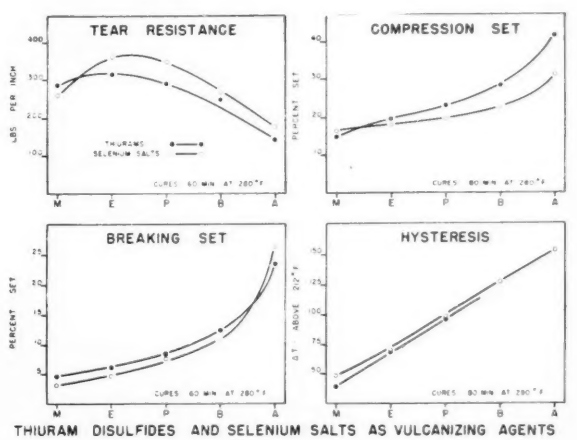


Fig. 14. Tear Resistance, Compression Set, Breaking Set, and Hysteresis for the Tetramethyl, Tetraethyl, Tetra-*n*-Propyl, Tetra-*n*-Butyl, Tetra-*n*-Amylthiuram Disulfides and the Selenium Salts of the Corresponding Dialkyldithiocarbamic Acids as Vulcanizing Agents in GR-S

metal dialkyldithiocarbamates were evaluated in GR-S on an "equal weight basis" as primary and as secondary accelerators. The tetraalkylthiuram disulfides and selenium dialkyldithiocarbamates were also evaluated as vulcanizing agents.

In general, the results show that an increase in the alkyl group decreases the activity of the accelerator. The slightly slower curing rate obtained with each methylene addition in the alkyl group is readily compensated, particularly in the lower members of the series, by slightly increasing the cure time without appreciable sacrifice in tensile strength, modulus, or elongation. The ethyl derivatives afford safer processing, less scorch, and greater freedom from bin cure, than the corresponding methyl compounds.

The various members in the homologous series, when employed as secondaries, may be interchanged with little effect on the physical properties of the vulcanizates.

The tetraalkylthiuram disulfides are more active accelerators than the monosulfides. The order of decreasing accelerator activity for the metal dialkyldithiocarbamates is copper, selenium, zinc, and lead. These generalities apply particularly to the ultras when used as primaries; however, the same trends, but to a lesser degree, are observed when they are employed as secondaries with mercaptobenzothiazole-type accelerators.

The selenium dialkyldithiocarbamates are faster curing vulcanizing agents than are the corresponding tetraalkylthiuram disulfides. As vulcanizing agents, these two homologous series follow the same order of accelerator activity as observed for their use as primaries, but to a more marked degree. The higher members of the series, particularly, exhibit a pronounced decrease in rate of cure as vulcanizing agents.

Acknowledgment

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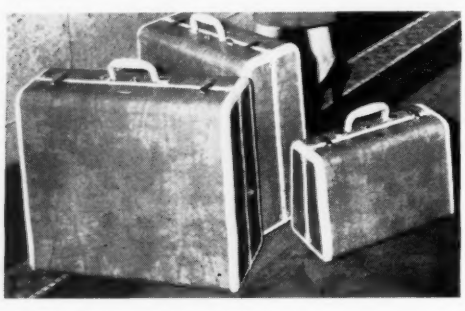

Plastic Luggage In Gay Colors

THE latest fashion news is budget-priced luggage in smart colors to complement milady's costume. Made of plastic Velon Flex, a product of Firestone Plastics Co., Akron 17, O., the luggage possesses remarkable resistance to wear and abrasion in addition to its smart appearance. The accompanying photograph shows Samsonite's Fashiontone trio of wardrobe, hat and shoe convertible, and vanity overnight case. A ladies' week-end bag and pullman case are also available. The entire line comes in the following colors: Bermuda green, pink copper, biege clay, admiral blue, and natural rawhide. Velon Flex can be cleaned easily with a damp cloth, and the colors will stay fresh and new looking indefinitely.

U. S. Rubber Industry Employment, Wages, Hours

	Prod. Workers 1000's	Prod. Workers Index	Prod. Workers Payroll Index	Ave. Weekly Earnings	Ave. Weekly Hours	Avg. Hourly Earnings	Consumers Price Index
All Rubber Products							
1939	121	100.0	100.0	$27.84	36.9	$0.754	99.4
1943	194	160.3	263.9	....	....	....	133.5
1948							
Jan	210	173.5	354.9	57.33	39.7	1.444	168.8
Feb	208	172.0	337.2	54.70	38.5	1.421	167.5
Mar	204	168.9	320.6	53.24	37.8	1.408	166.9
Apr	198	163.8	312.8	53.39	37.8	1.412	169.3
May	195	161.1	318.9	55.45	39.0	1.424	170.5
June	195	161.6	330.2	57.14	39.7	1.439	171.7
July	191	157.7	329.7	58.37	39.7	1.472	172.7
Aug	195	160.9	347.2	60.47	40.3	1.500	174.5
Sept	197	162.8	344.9	59.31	39.4	1.504	174.5
Oct	198	163.5	345.5	59.19	39.3	1.507	173.6
Nov	199	164.5	341.9	58.27	38.6	1.508	172.2
Dec	196	161.8	332.7	57.75	38.5	1.501	171.4
Tires and Tubes							
1939	54.2	100.0	100.0	$33.36	35.0	$0.957	
1943	99.1	166.1	265.7	....	....	....	
1948							
Jan	100.6	185.5	344.4	62.72	38.2	1.646	
Feb	98.0	182.4	315.4	58.22	36.0	1.613	
Mar	96.4	177.7	292.4	55.54	34.8	1.599	
Apr	92.6	170.7	286.4	56.54	35.3	1.603	
May	91.4	168.5	305.7	61.15	37.4	1.636	
June	91.9	169.4	322.0	63.96	38.8	1.651	
July	90.9	167.6	329.8	66.30	39.3	1.684	
Aug	91.5	168.7	341.0	68.29	39.5	1.730	
Sept	91.4	168.6	326.2	65.27	37.7	1.732	
Oct	90.0	165.9	318.2	64.82	37.2	1.734	
Nov	91.2	168.2	312.9	62.79	36.2	1.735	
Dec	89.6	165.3	299.6	61.10	35.6	1.721	
Boots and Shoes							
1939	14.8	100.0	100.0	$22.80	37.5	$0.607	
1943	23.8	160.5	268.8	....	....	....	
1948							
Jan	22.5	151.5	342.8	51.08	42.1	1.214	
Feb	22.8	153.8	345.0	50.65	41.7	1.214	
Mar	22.6	152.4	347.0	51.42	42.2	1.219	
Apr	22.1	149.0	333.9	50.59	41.7	1.214	
May	21.7	146.4	328.1	50.61	41.7	1.214	
June	21.8	146.9	329.7	50.69	41.7	1.215	
July	20.7	139.4	321.7	52.12	42.3	1.231	
Aug	22.0	148.3	344.1	52.53	41.5	1.266	
Sept	22.5	151.2	355.9	53.38	41.6	1.283	
Oct	22.9	154.0	369.0	53.86	42.2	1.278	
Nov	23.2	156.2	377.2	54.29	41.6	1.305	
Dec	23.5	158.0	388.2	55.23	42.4	1.303	
Other Rubber Products							
1939	51.9	100.0	100.0	$23.34	38.9	$0.605	
1943	79.9	154.1	255.8	....	....	....	
1948							
Jan	86.8	167.4	368.3	51.79	41.1	1.260	
Feb	86.5	166.9	366.2	51.33	40.8	1.258	
Mar	85.7	165.3	356.2	50.60	40.4	1.251	
Apr	84.0	161.9	347.1	50.16	39.9	1.256	
May	81.7	157.5	337.7	50.34	40.0	1.260	
June	81.7	157.5	343.7	51.15	40.2	1.272	
July	79.2	152.7	331.9	51.07	39.4	1.296	
Aug	81.0	155.8	356.3	53.70	40.9	1.312	
Sept	82.9	159.9	370.8	54.35	40.8	1.333	
Oct	84.7	163.4	383.0	55.08	40.8	1.350	
Nov	84.5	162.9	378.7	54.51	40.5	1.347	
Dec	82.6	159.2	370.0	54.64	40.5	1.349	

SOURCE: BLS, United States Department of Labor, Washington, D. C.

Rubber Technology and Research

(Continued from page 190)

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Photo-Elastic Applications in Rubber Technology—III[1]

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and Douglas Chalmers[2]

THERE are applications in rubber technology where it is desirable to compute actual stresses existing in some part of a product under some condition of deformation encountered in service. This information may be desired to insure the material selected has ultimate strength to withstand maximum service stresses. In certain rubber products ultimate stresses and strains are rarely encountered. The actual stress to be encountered in service is of particular value in such applications in order to design toward the stress-minima criterion of maximum dynamic life.

Quantitative Applications

Certain Limitations in Quantitative Application to Rubber Products

In spite of definite limitations in such quantitative application to rubber products, which we will discuss below, photo-elastic analysis does lend itself to determining actual stress value. Considerable work has been done, for example, in which Bakelite beams and other structures have been stressed, and the stress which was obtained photo-elastically has been checked against calculated values. In this case we can say that the photo-elastic determination of stress in a beam has an "analytic counterpart" in the sense that there are mathematical expressions for the calculated stress in the beam.

LACK OF ANALYTICAL COUNTERPART FOR CASES OF "LARGE BENDING." As we have pointed out, in rubber-like materials in service, such as hog beater paddles, milking machine inflations, diaphragms, tires, and belts, the deformation or unit strain is relatively large. For such relatively large strains a complete analytical (mathematical background is not usually available. This lack is a limitation in photo-elastic analysis applied quantitatively to rubber products in this sense only. It denies the opportunity in many applications for checking photo-elastic stress determinations against theoretical or calculated values.

Let us illustrate this principle further by a purely mathematical picture of the complication introduced by the condition of so-called large bending.

The basic expression applied to beams in small bending is an approximation:

$$M = EI \frac{d^2y}{dx^2}$$

where M = bending moment
E = modulus of elasticity
I = moment of inertia of the beam section

and $\frac{d^2y}{dx^2}$ is the curvature expression describing the beam deflection

For large bending, as exemplified by service conditions in rubber products, the complete expression must be used. This introduces obvious complications in the analysis. This complete expression would then be:

$$M = \frac{EI \frac{d^2y}{dx^2}}{\left[1 + \left(\frac{dy}{dx}\right)^2\right]^{3/2}}$$

THE NON-LINEAR RELATION. Photo-elastic analysis on rigid structures and using substantially rigid photo-elastic materials, such as Bakelite, lends itself to the use of Hooke's Law. In such cases the stresses and strains obtained show both a linear relation to each other and to the "fringe value."

In rubber-like materials the stress-strain relations are not linear, nor is the "fringe value" linearly proportional to stress-strain. This is a limitation in the use of this method only in the sense that it is therefore necessary to determine the "fringe value" across the entire range of strain encountered by the product in service and therefore introduced into the model.

LACK OF CRITICAL DATA ON PHOTO-ELASTIC MATERIALS. The literature lacks data on photo-elastic analysis applied to rubber products. There has not been published any extensive range of useful figures on photo-elastic constants of rubber-like materials relating "fringe value" with stress-strain, modulus, Poisson's ratio, etc. We do not deal with Poisson's ratio in this paper. It is a necessary coefficient in certain mathematical methods which can be used to check the results of photo-elastic analysis in particular cases. This lack of data is a limitation in the sense that the application of the method for quantitative purposes will be retarded by the necessity of collecting such information before the method can be successfully applied to a given problem.

CREEP AND RELAXATION EFFECTS. In the work done by the authors, attempts have been made to minimize the effects of creep and relaxation. The time required to load specimens has been reduced as much as possible to diminish these effects. We recognize that some errors exist because of these factors. It is felt that they are not serious. Creep and relaxation phenomena are limitations where particularly exacting data is required.

Necessary Physical Constants for Quantitative Photo-Elastic Analysis

The first step in the quantitative application of the method is the determination of the photo-elastic constants of the material being used. A calibrating sample of the model material is loaded throughout the entire range of strains to be encountered in the model. The "fringe values" associated with the stress, strain, and modulus are determined.

The calibrating sample may be one in tension, compression, or in bending. We have chosen the tensile method for this discussion because it lends itself better to explanation of the technique.

The apparatus employed for such a calibrating test is as shown in Figure 3.[3] A tensile dumbbell specimen is placed in clamps so that it may be observed between the plates of the polariscope. The lower clamp is held by a pin to a counterbalanced lever system so that the specimen can be loaded. The upper clamp is fixed.

[1] Presented before the Division of Rubber Chemistry, A. C. S., Los Angeles, Calif., July 22, 1948.
[2] Gates Rubber Co., Denver, Colo.
[3] See our Mar., 1949, issue, p. 719.

TABLE 2. PURE CREPE GUM COMPOUND *A*. TENSILE DUMBBELL ¼-by ONE-INCH by 0.075 (NOMINAL); STANDARD POLARISCOPE—SODIUM LIGHT; SPECIMEN PRECYCLED 10 TIMES; TEMPERATURE 75° F.

	Fringe Order	Load Lbs.	Z Length In.	X Thickness In.	Y Width In.	Area In.²	Stress: Original Area P.S.I. uncorrected	Stress: Actual Area P.S.I. corrected	Modulus: Original Area P.S.I. uncorrected	Modulus: Actual Area P.S.I. corrected	"Fringe Value," P.S.I. Tension	"Fringe Value," P.S.I. Shear	Average Fringe Value, P.S.I. Shear per Band
← Load →	0	0	1.04	0.0805	0.237	0.0191							
	1	0.364	1.27	0.072	0.212	0.0153	19.1	23.8	86.4	107.7	1.714	0.857	0.857
	2	0.618	1.66	0.0635	0.186	0.0118	32.4	52.4	54.4	87.9	3.32	1.66	0.83
	3	0.835	2.06	0.057	0.164	0.00935	43.7	89.3	44.5	91.0	5.08	2.54	0.85
	4	1.015	2.62	0.051	0.146	0.00745	53.1	136.2	34.9	89.6	6.94	3.47	0.87
	5	1.16	3.15	0.047	0.135	0.00635	60.7	182.7	29.9	90.0	8.58	4.29	0.86
← Unload →	4	0.981	2.71	0.048	0.145	0.00696	51.4	140.9	31.9	87.5	6.76	3.38	0.85
	3	0.798	2.22	0.055	0.160	0.0088	41.8	90.7	37.0	80.3	4.98	2.49	0.83
	2	0.581	1.77	0.062	0.182	0.0113	30.4	51.4	43.4	73.4	3.18	1.59	0.80
	1	0.327	1.37	0.071	0.213	0.0151	17.1	21.7	53.9	68.4	1.54	0.77	0.77
	0	0	1.07	0.079	0.234	0.0185	.....	.....	.....	.....	.....	.....	.....

TABLE 3. GEON 1437. TENSILE DUMBBELL ¼-by ONE-INCH x 0.075 (NOMINAL); STANDARD POLARISCOPE—SODIUM LIGHT; SPECIMEN PRECYCLED 10 TIMES; TEMPERATURE 75° F.

	Fringe Order	Load Lbs.	Z Length In.	X Thickness In.	Y Width In.	Area In.²	Stress: Original Area P.S.I. uncorrected	Stress: Actual Area P.S.I. corrected	Modulus: Original Area P.S.I. uncorrected	Modulus: Actual Area P.S.I. corrected	"Fringe Value," P.S.I. Tension	"Fringe Value," P.S.I. Shear	Average Fringe Value, P.S.I. Shear per Band
← Loading →	0	0	1.00	0.0715	0.251	0.0179							
	1	0.5	1.08	0.07	0.243	0.017	27.9	29.4	349	368	2.06	1.03	1.03
	2	2.16	1.16	0.0665	0.235	0.0156	120.7	138.5	753	866	9.20	4.60	2.30
	3	4.01	1.27	0.064	0.222	0.0142	224	282	830	1044	18.04	9.02	3.01
	4	5.56	1.39	0.0605	0.211	0.0128	311	434	797	1113	26.26	13.13	3.28
	5	7.50	1.53	0.058	0.201	0.0117	419	641	762	1165	37.18	18.59	3.72
	6	10.19	1.69	0.055	0.191	0.0105	569	970	825	1406	53.36	26.68	4.45

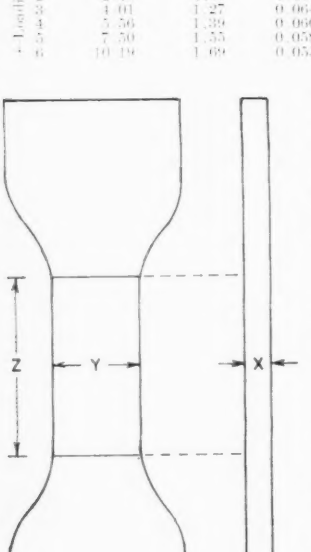

Fig. 11. Tensile Specimen of Uniform Cross-Section

Weights may be added or removed to produce the stresses desired.

Assume a homogeneous material in a tensile specimen of uniform cross-section, XY (Figure 11). As the loading in the polariscope is increased, employing white light, a succession of colors appear in the central portion, XY. Each color brought out by the increasing load will be uniform over this central portion of substantially uniform tensile stress. The sequence of colors obtained will be repeated as the loading continues. For calibration purposes it is sufficient to select only one color and observe the load increments causing its reappearance. If monochromatic light is used, the central portion of the specimen will alternately appear light and dark as the load is increased.

From measurements of load, length, thickness, width, and their changes as the specimen is stressed, we can compute constants such as shown in Tables 2 and 3 and derived in the following manner.

For purposes of discussion, let us take our loading tests on the gum rubber tensile specimen calibrated for preparation of Table 2:

Color Sequence	Fringe Order	Load (in Grams)
No color	0	0
First appearance of selected color	1	165
Second appearance of selected color	2	281
Third appearance of selected color	3	379
Fourth appearance of selected color	4	463
Fifth appearance of selected color	5	527

Let us suppose the tensile specimen under discussion is shown in Figure 11. Z is the distance between bench marks: Y is the width, and X is the thickness. The *change* in the value of Z (or ΔZ) divided by Z is the length strain, or the strain in Z. Similarly the *change* in the value of Y (or ΔY) divided by Y is the width strain, or the strain in Y. The thickness strain, X, is defined in a similar manner. The cross-sectional area of the central portion of the dumbbell at any load would be the product of thickness and width (e.g., XY) at the load. Similarly, volume would be the product XYZ at any load. For a substantially non-compressible material, volume should remain constant over the loading range. This provides a check on the accuracy of the linear measurements of X, Y, and Z.

If we obtain a value of load for each fringe order, then this value of load divided by the cross-sectional area (e.g., XY) will be the stress. If original area is used, we call the measurement "uncorrected stress." If the actual loaded area is used, we call the measurement "corrected stress."

Modulus is stress divided by strain. If the stress is calculated upon the original area of specimen, this modulus calculation will be "uncorrected" since it involves "uncorrected" stress. If corrected stress is used to calculate modulus, then the modulus will be "corrected."

Table 2 shows computations for a range of fringe orders in loading and unloading of crepe rubber gum compound *A*. The material fringe values in tension (Tables 2 and 3) were obtained by taking the corrected stress at a given fringe order and multiplying by the thickness of the specimen at this fringe order.

For example, in Table 2, the corrected stress for the first fringe order is 23.8 p.s.i., the thickness is 0.072-inch.

Material fringe value in tension = 23.8 (0.072) = 1.71 p.s.i. at fringe order, one, for one-inch thickness

As explained earlier, the fringe value in shear will be one-half that in tension, or 0.86 in the example given.

The average "fringe value", p.s.i., shear per band, as given in Tables 2 and 3 correspond to the classical definition of material "fringe value" "f". It is obtained by dividing the value in shear by the corresponding fringe order.

It will be noted that in Table 2 this value is substantially constant for the pure crepe rubber gum compound *A*. This is because across the range of loadings employed up to fringe order 5, an approximately linear stress-strain proportion applied. The effect of non-linear stress-strain upon fringe value per band is better shown in Table 3 for Geon 1437.

With the explanations given, the reader should be able to follow the entries in Tables 2 and 3.

Now, to apply data on the photo-elastic constant of a material in order to obtain the model fringe value, F, it is necessary to divide the material fringe value, "f", by the thickness, t. For rubber-like photo-elastic materials in models we must apply the particular "fringe value" associated with the fringe order at that point on the model. The thickness at that point must be used.

Expressed in equation form:

$$Ft = f$$

where F = model "fringe value" (in shear)
f = material fringe value (in shear)
t = thickness

With the above definitions in mind, we can easily understand the simple illustration from Frocht[1] relating fringe values in shear *versus* tension, and model *versus* material.

2F = 500 p.s.i., tension or compression stress model "fringe value"
F = 250 p.s.i. shear stress, model
f = Ft (where t = 0.1795")
= 250 (0.1795)
=44.9 p.s.i. in shear for material for one-inch thickness

Proof of the Quantitative Possibilities

We illustrate below how the methods described and the data of Tables 2 and 3 are employed to determine actual fiber stress. Examples chosen are a milking machine inflation section and a pressure diaphragm. As pointed out, however, in such practical applications, we frequently lack an "analytic counterpart" or independent basis for checking our results.

In order to "prove" the method we will first employ an example correlating beam theory results with those from photo-elastic analysis. It will be evident that quantitative application of photo-elastic analysis is both feasible and reliable to a practical degree.

EXAMPLE 1: CALCULATION OF BEAM STRESS FROM PHOTO-ELASTIC ANALYSIS:

A rectangular beam of Geon 1437 was placed in pure bending. Actual measured beam data were:

Initial span	9.00"
Span under bending moment of 1.59 lb. in.	8.60"
Corrected modulus for fringe order 2, Table 3	866 p.s.i.
Beam width	0.550"
Beam width	0.563"

In the polariscope it was observed that approximately 2½ fringes were developed in tension from the neutral axis of the beam. From Table 3

Stress (actual area) second fringe order	138.5 p.s.i.
Stress (actual area) third fringe order	282 p.s.i.
for 2½ fringes	209.3 p.s.i.

Interpolated stress (actual area)

Similarly, interpolated calibration tensile specimen thickness at 2½ fringe orders is equal to .066"

Therefore, actual tensile stress on outer beam fibers:

$$= \frac{(209.3)\ (0.066)}{0.550} = 25.1 \text{ p.s.i.}$$

From Beam Theory

Initial span—no load	9.00"
Span at load of 1.59 lb. in.	8.60"
Radius of curvature (calculated)	8.65"

$$\varepsilon(\text{Strain}) = \frac{\frac{\text{Thickness (depth)}}{2}}{\text{Radius of Curvature}}$$

$$= \frac{\frac{0.563}{2}}{8.65}$$

$$= 0.0326\ (3.26\%)$$

$$\text{Tensile Stress} = 866 \times (0.0326)$$

$$= 28.2 \text{ p.s.i.}$$

EXAMPLE 2: CALCULATION OF BEAM STRESS FROM PHOTO-ELASTIC ANALYSIS:

The same beam was stressed until 5½ fringes appeared. The bending moment was 2.17 lb. in. The data for the beam were:

Initial span	9.00"
Span under bending moment of 2.17 lb. in.	7.26"
Modulus for fringe order 5, Table 3	1165 p.s.i.
Beam width	0.550"
Beam depth	0.563"

From Table 3

Stress (actual area) fifth fringe order	641 p.s.i.
Stress (actual area) sixth fringe order	970 p.s.i.
Interpolated stress (actual area) for 5½ fringe orders	806 p.s.i.
Similarly, interpolated calibration tensile specimen thickness at 5½ fringe orders	.057"

Therefore, actual tensile stress on outer beam fibers:

$$= \frac{(806)\ (0.057)}{0.550} = 83.5 \text{ p.s.i.}$$

From Beam Theory

$$\varepsilon(\text{Strain}) = \frac{\frac{\text{Thickness (depth)}}{2}}{\text{Radius of Curvature}}$$

$$= \frac{\frac{0.563}{2}}{4.05} = \frac{0.563}{8.10}$$

$$= 0.0695\ (6.95\%)$$

$$\text{Tensile Stress} = (0.0695) \times (1165)$$

$$= 81 \text{ p.s.i.}$$

EXAMPLE 3: UNIFORM FIBER STRESS IN A TAPERED GEON 1437 CANTILEVER BEAM:

In Figure 12 we have five fringes counting from the neutral axis of the beam. From Table 3 we have a corrected (actual area) stress value of 641 p.s.i. The thickness of the calibration specimen was 0.058-inch. The thickness of the Geon 1437 cantilever beam was 0.550-inch. The maximum fiber stress in tension is therefore:

$$\text{Tensile Stress} = \frac{(641)\ (0.058)}{0.55}$$

$$= 67.5 \text{ p.s.i.}$$

[1] "Photoelasticity," Vol. I, p. 208, Fig. 6-56.

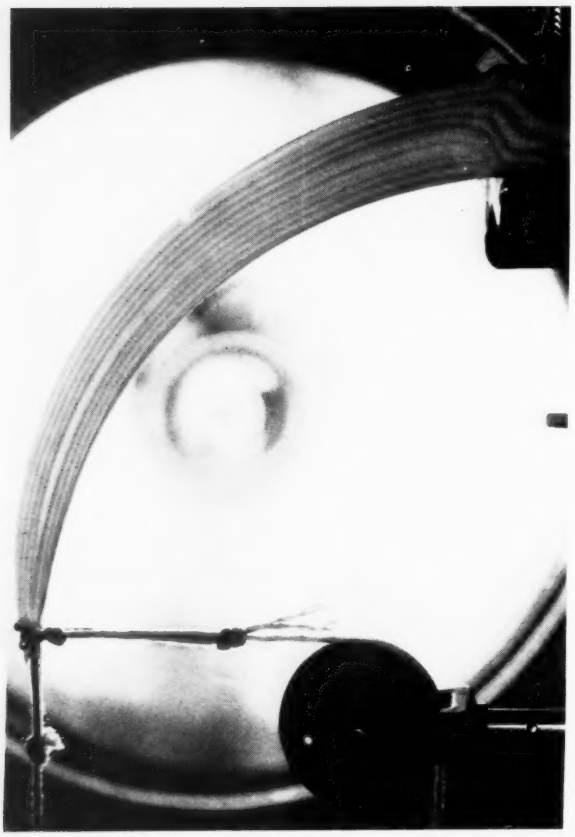

Fig. 12. Geon Cantilever Uniform Fiber Stress

EXAMPLE 4: MILKING MACHINE INFLATION SECTION:

At the high stress point in the milking machine inflation section (previously referred to) we were able to generate five bands. The section was 0.125-inch thick. Referring to Table 2 we find corrected stress to be 182.7 p.s.i. at a thickness of 0.047-inch.

$$\text{Tensile stress in milking machine inflation section} = \frac{182.7 \ (0.047)}{0.125} = 68.6 \text{ p.s.i.}$$

Maximum Shear Stress = 34.3 p.s.i.

EXAMPLE 5: PRESSURE DIAPHRAGM:

By stressing a Geon 1437 model diaphragm in the apparatus of Figure 4[5] to full extension of the piston, fourth order fringes were developed in the diaphragm. Selecting values from Table 3:

Corrected stress (fourth order)	434 p.s.i.
Thickness of calibration tensile specimen	0.0605"
Diaphragm thickness	0.203"

$$\text{Tensile stress in diaphragm} = \frac{(434) \ (0.0605)}{0.203} = 129.3 \text{ p.s.i.}$$

Maximum shear stress = 64.7 p.s.i.

EXAMPLE 6: "FROZEN" STRESS IN GEON PRESSURE DIAPHRAGM:

It may be desirable to study the resultant stresses in a complete product model under load. Stresses concurrently existing in non-adjacent or non-parallel planes under a particular loading may be of interest in a product as a whole. It can be seen that stressing cut sections does not portray the actual situation. Perhaps for a given loading condition not all sections of the complete product lend themselves to convenient photo-elastic measurement, or even simply observation.

The technique of "frozen" stress has proved particularly valuable for this situation. The model is made of a thermoplastic material, i.e., Geon 1437, and loaded at an elevated temperature such that stress relief occurs after a predetermined time. It is held at a fixed deflection corresponding to the subject load rather than at constant load.

After this stress relief period the model is cooled in the deflected position. When the model is relieved of the load deflection and returned to its normal shape, photo-elastic stress lines appear "frozen" in the complete product. Measurements and observations may then be taken from fringes observed in various cut sections in various planes.

By such a technique in a Geon 1437 model pressure diaphragm section of 0.34-inch, we determined the tensile stress from the three fringes observed:

From Table 3

Corrected stress, three fringe orders	282 p.s.i.
Tensile calibrating specimen thickness at three fringe orders	0.064"

$$\text{Tensile fiber stress} = \frac{(282) \ (0.064)}{0.34} = 53.1 \text{ p.s.i.}$$

Summary

Photo-elastic analysis has been shown to be a feasible and reliable method for anticipating design problems in rubber products. It lends itself qualitatively and quantitatively to the selection of materials, designs, and profiles for products, test specimens, and certain processing equipment. The apparatus, method, and calculations are relatively simple and inexpensive, as our description and examples have shown. It is hoped that other rubber laboratories will explore its possibilities further. More widespread use and publications dealing with this method will, we believe, contribute to a better understanding of rubber product performance and to more effective and economical use of materials.

Acknowledgments

We are indebted to several of our colleagues for their contributions to this paper: A. White, W. Redmond, and R. Schneider for selection of certain materials and products; Paul Carter for assistance in techniques, measurements, photographs; D. Stechert for useful calculations; and Miss Joy Nassimbene for the typing of the manuscript.

Walter Leaf, of the Denver & Rio Grande Railway generously introduced us to basic techniques in our earliest work. M. F. Torrence, of E. I. du Pont de Nemours & Co., Inc., provided us with the excellent pure gum formula, *B*, given in the text.

We gratefully acknowledge the permission of the Gates Rubber Co. to have this work published.

"Spinco Ultracentrifuges." Form 1S1148U8. Specialized Instruments Corp., Belmont, Calif. 8 pages. This illustrated booklet features the compact design of the new Spinco ultracentrifuge for use in purification and particle size determinations of polymers, proteins, viruses, and other colloids. The units contain all functions in a single housing, feature flexibility, safety, and simplicity, and contain an effective optical system of the refractive index type with automatic recording.

[5] See our Apr., 1949, issue, p. 68.

EDITORIALS

London Study Group Meeting Crystallizes Challenge to Natural Rubber

NATURAL rubber producers were disappointed by the turn of events at the recent Rubber Study Group meeting in London, England, but the American rubber goods manufacturing industry, in contrast, seems to feel that more was accomplished at this meeting than at some of the previous meetings. The reason for this latter attitude is based on the belief by the consuming industry in the United States that it has finally established the fact that consumption of synthetic rubber will continue in significant amounts each year because of preference for this type of rubber, even while natural rubber is readily available and relatively low in price.

Natural rubber producers have been complaining that the price is too low and that the United States holds the key to any rise in price as the major consumer. They have pointed out that if we would discontinue our voluntary consumption of synthetic rubber, the price of natural rubber would rise to a more "economic" level.

The American delegation to the Study Group meeting explained that this voluntary consumption was now a permanent part of our economy. Improvements in quality, uniformity, cleanliness, and the development of such types as "low temperature GR-S" have made synthetic rubber a preferred commodity to many American fabricators. An annual consumption between 250,000 and 500,000 tons of different types of synthetic rubber is likely to continue unless natural rubber can provide better materials for these uses and at lower price.

The Canadian delegation also emphasized that the production and the use of synthetic rubber were likely to be a permanent feature of the economy of that country and mentioned their development of export markets for synthetic rubber as an indication of their belief in its future.

William O'Neil, chairman of the board and president of The General Tire & Rubber Co., on his return to the United States after attending the Study Group meeting, stated that the natural rubber growers, mainly those from the Far East, were amazed that the future for synthetic rubber looked so bright.

"It was our position to show how synthetic rubber complemented rather than hurt the position of natural rubber," Mr. O'Neil pointed out. "We explained that more than a million tons of rubber were used in American manufacturing last year. Of this total rubber used, about 600,000 tons were natural rubber—or approximately the same amount as needed by the industry in prewar years."

The crux of the matter is that world production of natural rubber could rise to about 2,000,000 tons a year in the course of the next two or three years, and the production and the use of 400,000 tons of synthetic represent the difference between the present 1,600,000-ton annual production of natural rubber and the 2,000,000 potential. If this 400,000-ton market for synthetic rubber had not developed, natural rubber production and consumption could achieve balance and with a very good financial return to the producers.

It therefore becomes the responsibility of the producers of natural rubber to develop new markets for about a half million tons a year of their product, either in the form of new uses or by virtue of new and improved properties for their rubber or both.

There is evidence that in the field of new uses the natural rubber producing industry may have an outlet for a considerable additional tonnage of rubber powder in road construction. Stretches of state highway in Texas, Virginia, and Ohio will be built by June 1 in which powdered natural rubber will be incorporated with asphalt in order to improve road surfacing, according to Warren S. Lockwood in a talk before the Akron Rubber Group on April 15. Incorporation of the rubber in the bituminous binding material at the approximate rate of one-third to one ton of rubber per mile of surfacing material yields a superior road surface. A tremendously expanded use of natural rubber in this country, if the performance of the test highway sections lead to widespread use of rubber in asphalt road surfacing, was foreseen.

This program is being undertaken by the three highway departments in cooperation with the Rubber Development Bureau in Washington, D. C., of which Lockwood is the director, and the Dutch Rubber Foundation in Delft, also with the cooperation and sponsorship of the British Rubber Development Board, parent organization of the Washington agency. Excellent results with this-type road surfacing have been reported from Holland and Java, and sample pavement was recently laid in Akron, O., by the Goodyear Tire & Rubber Co.

Natural rubber producers are also making an extensive study of processing, warehousing, and shipping of rubber. French rubber producers are attempting a program of marketing their rubber according to more technical specifications, and the Socfin organization has announced special grades of low plasticity-high tensile rubber of guaranteed uniformity and cleanliness.

As has been pointed out in this column before, the natural rubber producers' best means of increasing the consumption of rubber in the United States is to come to this country and actively compete with the synthetic rubber being offered here. The establishment of a sales and technical service organization in this country through which the producers could learn first hand from consumers what types of rubber were desired and then do their best to provide them, at the same time following through on complaints at the consumer level, would be something of a departure from their past experience, but might yield surprising results.

DEPARTMENT OF
PLASTICS TECHNOLOGY

Protective Films from S-Polymers[1]—New Thermoplastics for Molding and Extrusion[2]

R. G. Newberg[3]

THE S-Polymers are high molecular weight copolymers of styrene and isobutylene produced by low-temperature polymerization techniques.[4] S-Polymers may be considered somewhat unique among plastics and resins since they can be employed alone as a plastic or blended with other plastics and several of the elastomers. S-Polymers exhibit rubber-like elastic properties in addition to their thermoplastic characteristics.

It is the purpose of this paper to discuss their properties in general, and present some suggested applications. Major emphasis will be placed on extruded and calendered film, and some experiments which have been conducted to demonstrate the applicability of S-Polymers in packaging fields which require a gas and moisture resistant barrier. Two polymers will be discussed, S-50 and S-60. These materials are quite similar except that S-50 is softer and more rubber-like than S-60. All test data reported were obtained by standard ASTM test procedures except where otherwise indicated in the following section.

Test Procedures

HEAT SOFTENING TEMPERATURE. This test was performed by conducting the normal Williams plasticity test[5] over a wide temperature range. By plotting plasticity and recovery *versus* temperature, an accurate heat softening point range was obtained with information on processing temperatures.

DISTORTION UNDER HEAT. This test was carried out as outlined in ASTM D-648-41T, except that a stress of 66 p.s.i. was used.

COEFFICIENT OF CUBICAL EXPANSION. The method employed was similar to a technique reported by Wiley,[6] consisting essentially of measuring specific volume expansion over a wide temperature range.

HEAT RESISTANCE. The samples were placed in a calcium chloride dessicator at 25° C. for four hours and weighed. They were then subjected to a constant temperature of 150° C. in an air circulating oven for the time indicated, again placed in the dessicator for four hours at 25° C., and reweighed. The % weight loss was recorded.

LIGHT TRANSMISSION. These data were obtained on a Hunter multi-purpose refractometer using air for reference at 100% transmission.

Physical Properties

The general physical properties of these two new polymers are shown in Table 1. The tensile strengths and heat softening temperatures compare quite favorably with plasticized thermoplastics in current use, such as polymers and copolymers of polyvinyl chloride. The extensibility or elongation, however, is considerably higher than the usual thermoplastics.

A very interesting point in conjunction with tensile strength, elongation, and processing is the fact that S-Polymers do not require the use of plasticizers for processing and may be termed self-plasticizing. As a consequence, they are not afflicted with those objectionable characteristics ordinarily associated with the use of plasticizers: i.e., leaching, odor, taste, etc. Furthermore the S-Polymers retain their original properties over long periods of time with no appreciable change in their appearance or physical strength. The resins, however, are compatible with most of the conventional plasticizers, and no problems are encountered in compounding when specific applications require the use of such materials as esters and oils.

The resistance of the S-Polymers to moisture vapor penetration and water absorption are probably the outstanding characteristics of these polymers. These properties have aroused much interest in the packaging field, particularly for fresh fruits and vegetables, dried fruits, frozen foods, and capsules. As indicated in Table 1, the water vapor transmission is as low as any thermoplastic in current use for packaging. Characteristic moisture vapor transmission *versus* film thickness is shown in Figure 1. Moisture vapor transmission is inversely proportional to the thickness, and it is interesting to note that even extremely thin films are excellent barriers.

Coupled with resistance to moisture vapor transfer, the S-Polymers also show excellent resistance to the penetration of gases, being equal or superior in this respect to a number of other plastics, including polyethylene, polyvinyl chloride polymers and copolymers, polystyrene, and cellophane.

The good electrical properties together with the low water absorption and water vapor transmission have stimulated much interest in S-Polymer for insulation. Inasmuch as these resins may be compounded with polyethylene, polyisobutylene, polystyrene, Butyl[1] rubber, GR-S, and even natural rubber, it appears that the polymers may prove very serviceable in the electrical field.

It was observed that the polymers were quite stable in sunlight and ultra-violet light. As shown in Table 2, ultra-violet light aging for a period of one week has

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[1] Trade name.

[2] Presented before annual Technical Conference, Society of Plastics Engineers, Inc., Philadelphia, Pa., Jan. 19, 1949.

[3] Esso Laboratories, Standard Oil Development Co., Linden, N. J.

[4] Covered by U. S. patent No. 2,274,749, March 3, 1942, and other patents and patent applications.

[5] Williams, *Ind. Eng. Chem.*, 16, 362 (1924).

[6] *Ibid.*, 34, 1052 (1942).

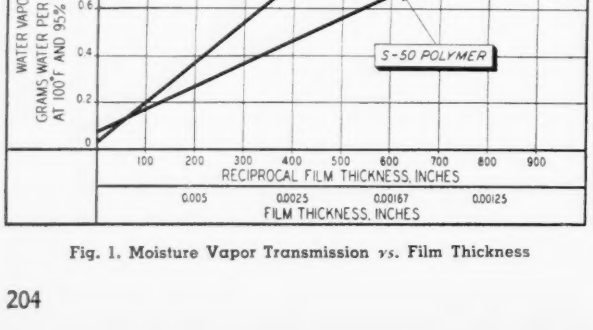

Fig. 1. Moisture Vapor Transmission *vs.* Film Thickness

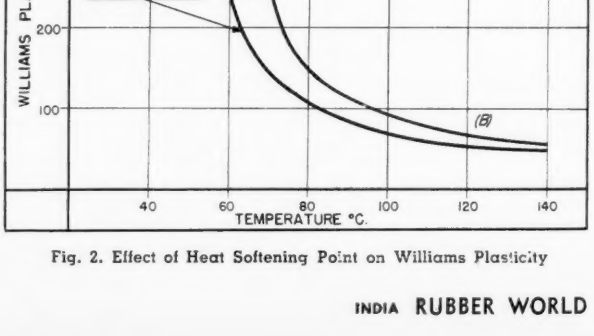

Fig. 2. Effect of Heat Softening Point on Williams Plasticity

TABLE 1. PHYSICAL PROPERTIES OF S-POLYMER

	S-50	S-60
Molding qualities	Excellent	Excellent
Compression molding temperature, °F.	280-340	300-360
Pressure, p.s.i.	300-2,000	300-2,000
Injection molding temperature, °F.	300-375	300-375
Specific gravity	0.98	0.99
Tensile strength, p.s.i.	1,000-2,000	1,500-3,000
Elongation, %	400-600	200-300
Compressive strength, p.s.i.	..	16,000
Flexural strength, p.s.i.	..	4,000
Impact strength, ft. lbs./in. notch:		
Izod, cantilever beam	..	0.3
Charpy, simple beam	..	10
Hardness, Rockwell	..	M-10
Coefficient of cubical expansion, cm.³/cm.³/°C.	1.250×10^{-6}	1.275×10^{-6}
Distortion under heat, °C.	.....	40
Light transmission on 0.0015-gage film	75%	90%
Refractive index	1.5505	1.5591
Dielectric strength, volts/mil	500-700	500-700
Constant at 25°C.	2.3-2.5	2.3-2.5
Power factor at 25°C.:		
60 cycles	0.00117	0.00117
10^3 cycles	0.00129	0.00143
10^6 cycles	0.00131	0.00162
Water absorption, % by weight	0.1-0.12	0.1-0.11
Burning rate	Fast	Fast
Heat softening point, °C.	45-55	55-65
Moisture vapor permeability, gms. water/100 sq. in. 24 hrs. for 4-mil gage film	0.3	0.8
Hydrogen gas permeability, liters sq. M 24 hrs. at 25° C. for 10-mil gage film	2.1	3.1
Effect of:		
Sunlight	Very slight	
Weak acids	None	
Strong acids, non-oxidizing*	Slight	
Weak alkalies	None	
Strong alkalies	None	
Organic solvents	Soluble in aromatics, aliphatics, halogenated hydrocarbons and ketones.	
Machining qualities	Poor	Good
Clarity	Slight opalescence	
Color possibilities	Unlimited	

* Nitric acid reacts with the polymers to make them insoluble.

TABLE 2. EFFECT OF ULTRA-VIOLET LIGHT AGING ON S-POLYMERS

	Original Value	After Aging in U-V Light for 168 Hours	% Retention of Original Value
S-50:			
Intrinsic viscosity	0.93	0.72	78
Tensile strength, p.s.i.	2,000	1,700	86
Ult. elongation, %	400	350	87
S-60:			
Intrinsic viscosity	0.68	0.57	84
Tensile strength, p.s.i.	2,200	2,000	88
Ult. elongation, %	200	100	50

TABLE 3. MILL BREAKDOWN OF S 50 POLYMER
Heat Softening Point, 129° F.

Mill Time Min.	Mill Temp., °F.	Intrinsic Viscosity
0	150	0.785
10	150	0.785
20	150	0.748
40	150	0.723
80	150	0.723
120	150	0.711
10	305	0.773
20	305	0.761
40	305	0.773
80	305	0.723
120	305	0.711

little effect on the tensile strength or molecular weight (as measured by intrinsic viscosity). Outdoor exposure tests of the S-Polymers have also given extraordinarily good results.

The heat stability of the S-Polymers is excellent. Laboratory milling of S-60 for 7½ hours at 300° F. reduced the intrinsic viscosity from 0.81 to 0.71, indicating little change in molecular weight. The results of other milling tests are shown in Table 3. It can be observed that the polymers are quite stable over a wide temperature range, and close control of temperature is therefore not necessary during processing.

TABLE 4. PROPERTIES OF S-POLYMERS EXPOSED TO CHEMICALS FOR SEVEN DAYS AT ROOM TEMPERATURE (MOLDED SLABS)

	S-50		S-60	
	% Increase in Weight	Polymer Appearance	% Increase in Weight	Polymer Appearance
Sulfuric acid, 30%	0.1	O. K.	0.1	O. K.
3%	0.2	O. K.	0.2	O. K.
Sodium hydroxide, 1%	0.08	O. K.	0.05	O. K.
10%	0.2	O. K.	0.1	O. K.
Methanol, 99.8%	0.2	O. K.	0.4	O. K.
50%	0.2	O. K.	0.2	O. K.
Acetone	32.7	Soft, gummy	32.0	Very gummy
Ethyl acetate (c. p.)	93.9	Very distorted	.....	Dissolved in 48 hrs.
Ethylene dichloride	.....	Dissolved in 8 hrs.	.....	Dissolved in 8 hrs.
Carbon tetrachloride	.....	Dissolved in 8 hrs.	.....	Dissolved in 8 hrs.
Toluene	.....	Dissolved in 8 hrs.	.....	Dissolved in 8 hrs.
Heptane	.....	Dissolved in 72 hrs.	.....	Dissolved in 72 hrs.
Sodium chloride, 10%	0.1	O. K.	0.05	O. K.
Distilled water	0.70	O. K.	1.2	O. K.
Nitric acid, 10%	0.1	O. K.	0.1	O. K.
Hydrochloric acid, 10%	0.01	O. K.	.....	O. K.
Acetic acid, 5%	0.3	O. K.	0.03	O. K.
Oleic acid	.....	Soluble	.....	Soluble
Ammonium hydroxide	0.3	O. K.	0.1	O. K.
Sodium carbonate, 2%	0.5	O. K.	0.2	O. K.
Hydrogen peroxide soln., 3%	0.5	O. K.	0.5	O. K.

TABLE 5. HOT MELT COATINGS OF S-50 POLYMER ON 50-LB. KRAFT PAPER

	(1)	(2)	(3)	(4)
S-50 Polymer	100	100	100	100
Acrawax B	3	3	3	3
Microwax, M. P. 170-175° F.	100	300	.....	.....
Paraffin wax, M. P. 135° F.	.....	.....	100	300
Coating temperature, °C.	150	150	150	150
Weight of coating, lbs. ream (500 sheets each 24 x 36 inches)	32	31	36	40
Tear strength (Elmendorf), p.s.i.:				
Control (untreated paper)	4.1	4.1	4.1	4.1
Coated paper	6.1	6.8	7.6	11.6
Moisture vapor permeability, gms. water 100 sq. in. 24 hrs. at 100° F. and 95% relative humidity:				
Uncreased	0.11	0.33	0.57	0.19
Creased	0.13	1.33	0.73	0.14

The relatively low coefficient of cubical expansion coupled with the thermoplastic properties of the polymer permits extrusion, calendering, and molding to close dimensional tolerances without undue difficulty.

S-Polymers are resistant to most chemicals ordinarily encountered. Weak acids and weak bases have no effect; strong acids and strong alkalies have little effect. The polymers are soluble in organic solvents. A somewhat detailed table of chemical resistance of these polymers is shown in Table 4. It is, of course, evident that since the polymers are thermoplastic, they cannot be used for exposure to chemicals at high temperatures.

Processing Characteristics

The S-Polymers can be processed on conventional plastic or rubber fabricating equipment. Banbury or mill compounding is easily accomplished at temperatures between 200 and 350° F.; the higher the temperature, the less power required.

Typical heat softening curves, as shown in Figure 2, quite clearly illustrate the best processing temperatures. The plasticity curves exhibit two distinct transition points or temperature ranges, (A) and (B). The point (A) may be considered to be the heat softening point, for here the resins first exhibit deformation and thermoelasticity. The point (B) may be considered the initial temperature at which the polymers become truly thermoplastic and approach a liquid phase. Above point (B) the polymers exhibit little, if any thermoelasticity. It is therefore essential that extrusion, calendering, molding, and milling operations be carried out above this latter temperature, or else much orientation and stress deformation may result.

At point (C) the polymers show maximum rubber-like properties. A curve plotting Williams recovery against heat softening point will show a sharp peak at point (C). Extrusion temperatures of 300-325° F. with a die temperature of 150-250° F. have proved quite satisfactory, and films as thin as 0.1-mil have been extruded successfully. Calender temperatures in the 300-350° F. range are required to keep orientation at a minimum. The polymers readily adapt themselves to calendering. Self-supported films have been calendered over the 0.005-0.010-inch gage range. Coatings of the polymers may be calendered on paper, glass fabrics, cotton fabrics, and even metal foils, rendering these materials quite resistant to moisture and gas. The polymers may be injection and compression molded with good results, when conventional equipment is used and satisfactory production schedules are maintained.

Although the polymers may be processed satisfactorily without processing aids, it is generally recommended that small concentrations (0.5-3%) of parting aids be used, such as metallic soaps, octadecyl amine, or similar lubricants.

The S-Polymers are soluble in aliphatic and aromatic hydrocarbons. They therefore make suitable cements for casting and may be band cast to form self-supported films, or coated on paper, Fiberglas, cloth, etc. S-Polymers also make excellent water emulsions and may be processed in organosol-type solutions using ketones, acetates, and alcohols. The polymers are readily soluble in waxes, and excellent hot melt coatings may be made by kneading the polymers directly in hot wax.

For packaging operations it is necessary that the packaging medium heat seal at reasonable processing temperatures. The S-Polymers heat seal at temperatures ranging from 220° F. up and may be adapted readily to conventional packaging equipment.

Applications

In the discussion of physical properties and processing, numerous possible applications may occur to the industrial fabricator. The following are several specific applications for which experimental data have been obtained.

HOT MELT COATINGS. The simple process for making hot melt coatings was described briefly in the preceding section.

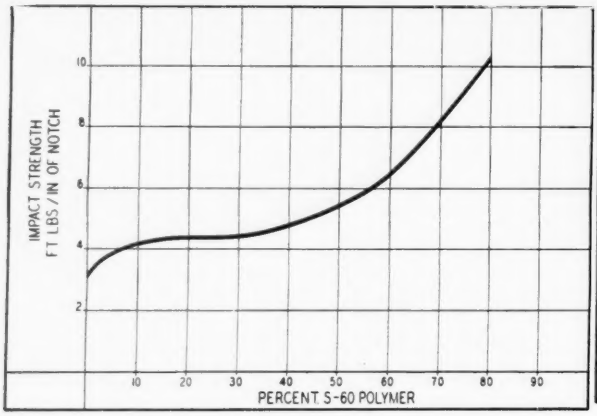

Fig. 3. Charpy Impact Strengths of S-Polymer-Polystyrene Blends

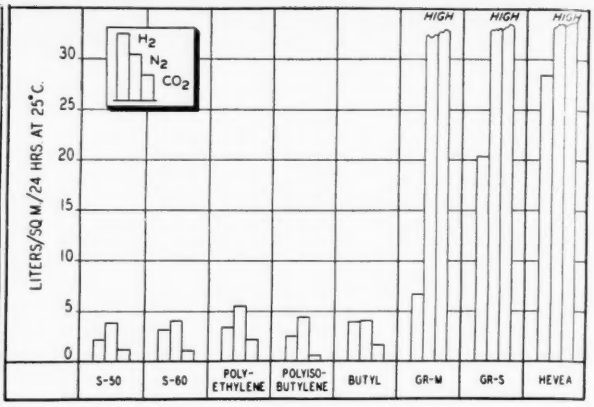

Fig. 4. Gas Permeability of Various 10-Mil Films

Data on typical S-50 hot melt wax coatings applied on 50-pound Kraft paper are shown in Table 5. The interesting features of this work are the marked improvement in tear strength of the paper and the remarkable flexibility of the coating as shown by the moisture vapor resistance after creasing.

In the field of hot melt coatings, pale crepe wax blends have been used for some time to coat cellophane. Data on a representative S-50 wax coating *versus* pale crepe wax coatings on cellophane are shown in Table 6. The improved flexibility, better moisture resistance, increased tensile strength, and increased elongation of the S-50 wax coating should be interesting to fabricators in this field.

Table 6. Comparison of Hot Melt Cellophane Coatings

	(1)	(2)
Crepe rubber	30	
S-50 Polymer		30
Microwax, M. P. 170-175° F.	70	70
Tensile strength, p.s.i.	78.0	127.5
Elongation, %	20	180
Moisture vapor penetration, gms. water 100 sq. in. 24 hrs. (coated to equal weight on cellophane)	0.3218	0.0998

The S-Polymers give evidence of being important as processing aids for blends of vinyl resins with nitrile synthetic rubbers. Young and others[7] presented data on combinations of S-Polymers with Paracril-Vinylite VYNW blends. The improvement in processing is noticeable in the extrusion rates. Other advantages gained through use of S-Polymers are higher tear strength and better aging characteristics.

Phenolic Resin Modification. Experiments on the use of S-Polymers in compounds composed of nitrile synthetic rubbers blended with phenolic resins yielded interesting results.[8] The most interesting point brought out by this work was that S-50 improves the tear resistance. It was also discovered in the molding operation that compounds containing S-Polymers could be removed without cooling from the hot molds with little danger of tearing.

Blends with Polystyrene. Polystyrene may be modified by blending with S-60 to give improved impact strength, as shown in Figure 3. Concentrations up to 20% S-60 in the blend also give better machineability and flow properties, and there is also some indication that resistance to crazing and checking is improved. A slight opalescence accompanied the addition of the S-Polymer, which is probably attributable to the inherent opalescent characteristics of this resin. As might be expected, increasing concentrations of S-60 result in some reduction in tensile strength, flexural strength, hardness, compression strength, and heat softening point.

Blends with Polyethylene. The S-Polymers may be blended with polyethylene, and some typical data are shown in Table 7. The outstanding contribution that S-Polymers have to offer in modifying polyethylene is to increase the heat softening or molding temperature range, making it better processing. As shown in Table 7, the initial heat softening point is relatively little affected. Only small concentrations of S-Polymers are necessary, and they do not have any marked effect on the other attractive properties of polyethylene.

Table 7. Blends of Polyethylene and S-Polymer

	(1)	(2)	(3)
Polyethylene	100	85	85
S-50	...	15	.....
S-60	...	...	15
Acrawax B	2.5	2.5	2.5
Stearic acid	1.0	1.0	1.0
Heat softening point, °C.	100	100	95
Extrusion (265° F., 80 rpm., 0.400-inch die:			
Inches per minute	30	33	33
Grams per minute	80	96	100
Appearance	Rough	Intermediate	
Tear strength, lbs. in.	456	411	334
Tensile strength, p.s.i.	1,750	1,530	2,010
Elongation, %	590	610	380
Heat resistance: % wt. loss after 168 hrs. at 150° F.	1.33	1.73	3.07
Bell brittleness, ASTM	—80	—60	+30
Moisture vapor permeability, gms. water/100 sq. in. 24 hrs. for 10-mil film	0.392	0.186	0.39
Grease resistance, 7 days in Crisco at 77° F.:			
Weight change, %	0.15	0.53	0.26
Appearance change	None	None	None

Compounding with Elastomers. The S-Polymers are compatible with *Hevea*, balata, GR-S, Butyl, and the nitrile rubbers. The chief functions of the polymer might well be to aid in processing, improve light stability, lower the rate of diffusion of gases and water vapor, and modify for specific uses. A recent interesting development is the modification of standard GR-S to produce a satisfactory shoe sole material.

Sound Recording Material. Certain investigations have revealed that S-60 has some potentialities for sound recording material, and an experimental record compound is shown in Table 8.

The compound was Banbury mixed in one cycle for 10 minutes at 300° F. Molding was done for 15 minutes at 330° F. and 900 p.s.i. pressure, with the record then cooled under pressure and removed from the mold. The material was field tested with encouraging results. This work also illustrates a feature not touched on previously, that is, the ability of S-Polymers to accept fillers. The polymers may be compounded with substantial volume loadings of all types of fillers, such as carbon blacks, cork, wood flour, clays, macerated leather, cotton flock, asbestos, mica, etc., with good results.

Table 8. Experimental Record Molding Compound

	Parts
S-60 Polymer	90
EPC black	10
Zinc stearate	1.5
Carnauba wax	5
Slate flour	150
Whiting	150
Acrawax B	5

Fresh Fruit Packaging. During recent years a great deal of research work has been carried out to develop techniques and materials for packaging and transporting fresh, frozen, and dried foods to the consumer in such a manner as to provide the ultimate in quality and economy. To date the results of these investigations have been extremely encouraging and have revealed some interesting points. Respiratory breakdown and decay can be controlled by chemical treatment and the use of a proper packaging material. Satisfactory packaging machines have been designed and built.

Numerous experiments on many types of films for packaging have demonstrated that in order to be effective such materials must be highly resistant to the penetration of moisture and gases. The excellent resistance of S-Polymers to moisture vapor penetration has already been discussed, and their resistance to gas permeation is also quite good, as shown in Figure 4. It is immediately apparent that the S-Polymers are quite comparable to or better than the best film materials in use today.

Being living matter, fresh fruit and vegetables experience the normal life processes: they respire, lose water in transpiration, and are subject to slow chemical change. Ideal packaging demands that these normal life processes be retarded without, however, stopping them completely. This condition may be achieved by controlling the amount of oxygen inhaled, thereby restricting the amount of aerobic respiration. At the same time dehydration is controlled and restricted to avoid excessive drying by loss of moisture. The life of the fruit, of course, depends upon how long its supply of stored foods will hold out against oxidation.

Early experiments indicated that some method of ventilation through the packaging material was necessary to secure the proper chemical balance for satisfactory storage, and investigations to check this

[7] D. W. Young, R. G. Newberg, R. M. Howlett, *Ibid.*, 39, 1446 (1948).
[8] R. G. Newberg, D. W. Young, W. A. Fairclough, *Rubber Age*, 62, 533 (1948).

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point proved quite interesting. Fresh oranges and lemons were sealed in S-50 bags constructed of two-mil calendered film, carefully inspected to insure absence of pin holes or other imperfections. After the fruit was sealed in the bags, holes 0.033-inch, in diameter were pinched so as to provide a range of bags having 0 to 20 holes. The fruit was then stored at ordinary atmospheric conditions, and weight loss and failure noted over a period of several weeks.

Fruit packaged in bags having no holes failed completely in less than four weeks, and the packages became quite distended with accumulated gases. Furthermore the fruit molded rapidly and became inedible in less than two weeks. The fruit packaged in ventilated bags, with even as little as one hole per bag, survived for the duration of the test (10 weeks) and were satisfactorily edible and pleasing in appearance. As expected, the greater the magnitude of ventilation the higher the weight loss from dehydration. It appeared evident that even a small amount of ventilation is quite adequate.

S-Polymer calendered films were also compared to other film materials in current use, such as polyethylene, rubber hydrochloride, moisture-proof cellophane, waxed paper, etc., in packaging tests with fresh oranges. In these experiments all packages were made up as nearly as possible from films of equal thickness and ventilated to about the same degree. S-50 and polyethylene were quite comparable in these tests, as might be expected, since both are good in moisture vapor resistance. Similar results were also obtained with film made from an experimental blend of polyisobutylene and PS-60, a low molecular weight S-Polymer. Rubber hydrochloride film showed a low weight loss, but had 100% fruit failure before nine weeks had elapsed. No explanation can be offered for this high percentage of failure. In all the tests the S-50 wrapped fruit showed the lowest percentage of failures. Even at the end of the 32-week test period the fruit wrapped in S-50 were firm, posssesed the appearance of being freshly picked, and were satisfactorily edible.

Dried Fruit Packaging. It appears that the ideal packaging material for dried fruits would be one which would restrict the oxygen supply almost completely and prevent the transpiration of moisture and sufur dioxide gas from the package. In order to determine the applicability of S-Polymers for preserving dried fruit, a series of packaging tests was conducted comparing two-mil films of calendered S-50 with moisture-proof cellophane for wrapping ½-pound packages of raisins, prunes, and mixed dried fruit. The packages were sealed and checked for weight retention, appearance, and edibility over a period of 21 weeks. At the conclusion of the test those fruits packaged in S-50 retained their original freshness, taste, appearance, and approximately 98% of their original weight. Those packaged in cellophane became progressively harder and more discolored as the test progressed and after 21 weeks had lost from 15 to 17% of their original weight.

Summary and Conclusions

The S-Polymers have many attractive properties to recommend them, the most important of which are easy processability, good electrical resistance, good physical strength, outstanding resistance to the penetration of moisture vapor and gases, low specific gravity, and a ready compatibility with a large number of resins and elastomers.

As film forming materials, they may be ideal for many packaging applications, such as for fresh, dried, and frozen foods. Other packaging fields might well be dry chemicals and tobacco. Other possible applications, many of which have been investigated with encouraging results, include capsules for aqueous and alcoholic solutions; coatings and impregnations; electrical appliances; electrotype plates; laminates with fabric, Fiberglas, and paper; moisture-proof paper coatings, either calendered, cast, or hot melt; recording material; molded articles; packaging material for other resins and polymers; modification of other resins and elastomers; and vacuum packaging.

The advice, encouragement, and assistance of W. J. Sparks, R. M. Thomas, J. R. Briggs, P. E. Hardy, O. C. Slotterbeck and the laboratory staff of the chemical division, Standard Oil Development Co., during the course of the work are greatly appreciated by the author.

SPI Pacific Coast Conference

THE Pacific Coast Section, The Society of the Plastics Industry, held its sixth annual spring conference on March 17 to 19 at the Biltmore Hotel, Santa Barbara, Calif. An attendance of more than 160 members and guests took part in the three-day conference, which included technical sessions, luncheon and dinner meetings, and a special program for ladies.

Program of First Day

The morning technical session, March 17, presided over by C. C. Booth, Glen H. Taylor Co., featured three talks: "Practical Molding," E. W. Borro, Durez Plastics & Chemicals, Inc.; "Vinyl Molding and Extrusion," David Plumb, Monsanto Chemical Co.; and "Techniques of Handling Polyethylene," J. K. Honish, Bakelite Corp.

Mr. Borro gave a comprehensive talk on phenolic molding, including plastic part design, material selection and the effect of fillers on properties, preheating methods, molding methods, finishing operations, and on the molding of large parts. Mr. Plumb noted that vinyls are first in dollar volume of plastics sales and second in pounds distributed. After a review of the growth of the vinyl industry, the speaker discussed some of the large uses for vinyls, including hose, belting, tubing, profile extrusions, film and sheeting for furniture upholstery, wearing apparel, and accessories, coated fabric and paper, and floor coverings. Mr. Honish's talk covered the methods of bonding, casting, coating, extrusion, laminating, machining, and molding polyethylene.

The luncheon session was under the chairmanship of F. T. Kebely, K-Plastix, and the speakers were W. T. Cruse and G. H. Clark, SPI executive vice president and president, respectively. Mr. Cruse reviewed developments in extrusion, injection molding, thermosetting materials, film and sheeting, fabricating, and laminating. The speaker declared that 1948 was a banner year for plastics and that 1949 will also be a good year for alert individuals. Mr. Clark said that SPI is the plastics industry's management group; while SPE aims toward upgrading the plastics engineer. SPI is going ahead with the development of standards promoted and accepted by management, particularly in the sheet and film field.

Four papers were presented at the afternoon session, with Elbert Davis, New Plastic Corp., presiding: "Low Pressure Laminating Using Polyester Resins," J. H. Wyckoff, American Cyanamid Co.; "Polystyrene—The Work Horse of the Thermoplastics Industry," Gordon Thayer, Dow Chemical Co.; "Developments in the Uses of Paste Resins," G. B. Koch, B. F. Goodrich Chemical Co.; and "Alkyd Molding Compounds," W. N. Shepard, Plaskon Division, Libbey-Owens-Ford Glass Co.

Mr. Wyckoff described the three methods of laminating used by the "low" pressure industry: no pressure, fluid pressure, and positive pressure. The speaker discussed the techniques employed with each method, the materials so handled, and their applications. Mr. Thayer noted the existence of the following problems in polystyrene molding: (1) reduced crazing and better quality; (2) faster cycles and better molding and mold release; (3) better toughness and elongation; (4) better light stability; and (5) better heat resistance. These problems have been solved to some degree in individual cases, the speaker said, but much work remains to be done. Mr. Koch stated that two types of vinyl pastes are in use: plastisols, which are dispersions of resin in liquid plasticizer without diluent; and organisols, which differ in that volatile diluents are included. The applications for each type of material were described, and the speaker noted the rapid growth in use of such pastes in fabric coating, particularly to replace pyroxylin coating. Mr. Sheppard dealt with the development and properties of Plaskon 420-1, an alkyd molding material of widespread interest.

The dinner-meeting, presided over by D. C. Severance, Lee Deane Products, Inc., featured talks on "Current State of the Industry," by W. S. Landes, Celanese Corp. of America, and "Science in Daily Life," by C. W. Porter, University of California.

Events of Second Day

Two talks were presented at the morning session, under the chairmanship of Lisle Reinhold, Reinhold-Geiger Plastics. J. E. O'Hagan, Allied Records Co., spoke on "Right or Left in Labor Relations," and W. A. Dew, E. I. du Pont de Nemours & Co., Inc., spoke on "Preview of Progress." Mr. O'Hagan stressed the following fundamental principles to be followed in labor relations: (1) protect and respect the rights and property of the other man; (2) do not deny the other man the expansion of his talents if they harm no one; (3) bad acts by groups or individuals cannot be condoned or justified just because they bring good results or are approved by the majority; and (4) the slogan, "Business is business," does not give one the right to indulge in sharp practices, and by the same token morality does not imply softness. Dr. Dew discussed the role of science in the improvement of living and described some of the newer developments, including titanium metal and Orlon acrylic fiber.

H. H. Wenk, Plastics Process Co., presided over the luncheon session at which three talks were made: "Designing for Production in Plastics," J. O. Reinecke, industrial designer; "Put Your Supplier's Dollars to Work for You," D. L. Gibb, W. R. Dixon, and A. R. Ruddock, Dow Chemical; and "End-Use Selling of Plas-

ties," A. R. Olson, Hercules Powder Co.

Mr. Reinecke said that custom molders and fabricators do not need designers, but should insist on good design to maintain sales. The engineer thinks of utility, while the artist thinks of appearance, and the designer combines both viewpoints to develop a salable product. Mr. Gibb said three phases exist in selling plastic products: advertising, sales promotion, and merchandising. Surveys of consumers and buyers of plastic products have shown the need of three essential sales elements: (1) fine merchandise in both quality and design; (2) sound distribution through enthusiastic jobbers; and (3) fair pricing policies. Mr. Dixon discussed the role of advertising and sales promotion by the manufacturer to increase sales; while Mr. Ruddock displayed samples of national advertising and discussed their effect on the retailer and the consumer. Mr. Olson told about several cases where his company had engineered a product through from the design to selling stage in order to stimulate sales of its plastic materials. This service in design supplements national advertising and is very useful in stimulating interest, the speaker declared.

Approximately 250 members and their wives attended a cooperative materials and equipment suppliers' cocktail party Friday evening, followed by a banquet, entertainment, and dancing.

Concluding Session

A golf tournament was scheduled for the morning of March 19 at the Montecito Country Club, but was postponed on account of rain. There were no other formal sessions scheduled during the day except for an afternoon bridge party, with prizes supplied by the Pacific Coast Section.

Canadian SPI Conference

THE seventh annual conference of the Society of the Plastics Industry (Canada), Inc., was held February 15 and 16 at the General Brock Hotel, Niagara Falls, Ont. The conference opened with introductory remarks by General Chairman G. Murray Scott, Dow Chemical of Canada, Ltd., and Society President Irving D. Wintrob. The two-day program consisted of sessions on technical and merchandising problems, luncheon and dinner meetings, and the Society's annual business meeting.

The morning session the first day, under the chairmanship of Lloyd Falkenhagen, Jos. Stokes Rubber Co., Ltd., consisted of a talk on "The Effects of Informative Labeling on the Plastics Industry, Its Sales and Its Profits," by Elmer French, Firestone Plastics Co., and Charles Sandak; and a discussion of "Merchandising" by W. R. Dixon, Dow Chemical Co. Messrs. French and Sandak, who are chairman and marketing counsel, respectively, of the SPI committee on informative labeling, described the work of the committee and the advantages of a program of informative labeling. Mr. Dixon advocated that manufacturers cast off tradition and timidity and arm themselves with modern merchandising techniques.

A. E. Byrne, Canadian General Electric Co., presided over the luncheon session at which C. A. Breskin, *Modern Plastics*, was featured speaker. Mr. Breskin urged the need of study and action to develop products of the most practical value and quality, with control of costs to bring consumer prices within the resistance level now becoming evident.

Three papers were presented at the afternoon session, presided over by S. Kaufman, Kayson Rubber & Plastics, Ltd.: "Plaskon Alkyd Molding Compound," H. E. Murray, Libbey-Owens-Ford Glass Co.; "Injection Molding Is Big Business," E. L. Hobson, Monsanto Chemical Co.; and "The Calendering and Sheeting Industry," Robert Dettelbach, B. F. Goodrich Chemical Co. Mr. Murray described the development of Plaskon alkyd molding compound and gave information on its properties, cure, molding features, and molding and fabricating equipment. Mr. Hobson reviewed the growth of the injection molding industry and described some of the newer developments in injection molding, such as the use of pin-point gating. Mr. Dettelbach discussed the growth of the vinyl film and sheeting industry and in particular the use of four-gage film as a new textile material. Progress has been made in compounding vinyl resins, but some still unsolved problems remain, including the need of development of more ideal plasticizers, stabilizers, and coloring materials.

The Society's annual dinner took place the evening of February 15, following a cocktail hour. Mr. Wintrob presided over the dinner, and R. E. Oliver, Ford Motor Co. of Canada, Ltd., was guest speaker. Mr. Oliver spoke on "Science and Survival," emphasizing the need of new philosophy, embodying high vision, intelligent inquiry, and patient persistence, in this dawning era of atomic power.

The morning session, February 16, under the chairmanship of R. S. Rogers, Canadian Cellulose Products, Ltd., featured the showing of two films, "The Scientific Approach to Better Plastics" and "The Story of Tenite," followed by two talks: R. M. Richardson, Arborite Co., Ltd., discussed "Arborite—The New Canadian Decorative Laminate," and John Sasso, *Business Week*, spoke on "The Plastics Industry in a Changing Economic Climate." Mr. Richardson described the development of Arborite, its properties, and its use in decorative applications. Mr. Sasso discussed the business outlook for 1949, with special reference to the plastics industry, and foresaw its further development and expansion.

Don Henshaw, MacLaren Advertising Co., Ltd., was principal speaker at the luncheon session, presided over by Howard Yates, Crystal Glass & Plastics, Ltd. The time has come, Mr. MacLaren said, for a change of attitude on the part of Canadians to make known what Canada has already done and what it can offer for further progress.

The Society's annual meeting took place in the afternoon, with Mr. Wintrob again presiding. He reviewed the work of the Society during the past year and its plans for the forthcoming year. Election of officers and councillors of the Society for the coming year were held with the following results: president, L. C. MacLeod, Monsanto (Canada), Ltd.; vice president, Mr. Yates; treasurer, T. J. Carey, Canadian General Electric Co., Ltd.; and councillors, Mr. Scott, George Whyte, Dominion Comb & Novelty Co., C. L. Gretsinger, Jos. Stokes Rubber Co., I. W. Smith, Haugh's Products, Ltd., R. J. Southwell, Canadian Resins & Chemicals, Ltd., and Mr. Wintrob.

The following trade section chairmen were also elected: thermoplastic section, Mr. Whyte; thermosetting section, Mr. Gretsinger; fabricators section, Mr. Smith; and materials section, Mr. Southwell. Election of the chairman for the extruders section will take place by mail ballot.

Industrial Vinyl Film

TYPE 7051 vinyl film for industrial uses is now being offered for sale in rolls by the industrial and general products division of The B. F. Goodrich Co., Akron, O. According to E. F. Tomlinson, division general manager, the translucent clear film is already having wide service in industrial aprons, protective cuffs, table coverings in hosiery mills, office equipment covers, and other applications. It is made for use at normal room temperatures, but is satisfactory in colder or warmer conditions if "hand" and flexing are not primary requirements.

Made in 36- and 54-inch standard widths, rolls of 0.004-gage are 200 or 250 yards long; 0.006-gage are 130 or 160 yards long; and 0.008-gage are 100 yards long. The film is packaged on six-inch cores; the finished rolls have an outside diameter of about 9½-10 inches and are packaged in rigid tubes. Uniform frosted surface of the film, imparted by special calenders, prevents sticking or "blocking" and gives it a "dry hand." The film can be printed with special vinyl inks, fabricated on regular sewing equipment, or bonded with high-frequency heaters.

New Vibrin Polyester Resin

A NEW, nearly water-white polyester resin which makes possible clear color casting and impregnating work hitherto possible for the most part only with thermoplastic materials has been developed by Naugatuck Chemical Division, United States Rubber Co., Rockefeller Center, New York 20, N. Y. Known as Vibrin 108, the new resin is said to permit decorative work with clear color and high color retention. Its low water absorption favors its use in outdoor applications. When a peroxide catalyst is used, curing takes place at medium temperatures, and cures may be initiated at lower temperatures when promoters or low temperature catalysts are used. The resin has a color specification of 65 APHA units, and is adaptable to continuous laminating or to casting wherever the best color retention is required.

New Name for Tuf-Lite

THE chemical division, Goodyear Tire & Rubber Co., Akron 16, O., has adopted a new name, Plio-Tuf, for its impact resistant rubber-resin blend. Originally introduced last October at the third National Plastics Exposition under the name of Tuf-Lite, the material is characterized by its extremely high impact resistance, low gravity, low water absorption, excellent moldability and machinability, and wide color possibilities. The blend has created much interest since its introduction, and many of the interested parties have expressed a desire to use the name Tuf-Lite in conjunction with their own sales promotion and advertising. Trade name difficulties encountered in recent months have forced the abandonment of the original name and the adoption of the name Plio-Tuf. The new name has been fully cleared by Goodyear's legal department and is open to use by any of the company's customers.

Monthly Reports Received from SPE Sections

SOME 44 members and guests of the New York Section, Society of Plastics Engineers, attended a regular dinner-meeting on April 12 at the Hotel Shelburne, New York, N. Y. Speaker of the evening was Russell B. Akin, E. I. du Pont de Nemours & Co., Inc., who discussed "Nylon as a Plastic Molding Material."

Dr. Akin emphasized that nylon is a generic name for a class of plastic materials. A dozen types of nylon molding powders are now in commercial production and provide a wide range of properties. The standard grade of nylon for molding is FM-1, the most rigid and heat-resistant type. Nylon has five important properties: (1) high unloading temperature, being dimensionally stable to 450° F. although the service temperature is closer to 300° F. because stiffness decreases with increasing temperature; (2) does not contain plasticizer and is therefore not subject to bleeding and to low temperature embrittlement; (3) high toughness, the material being horny in nature; (4) excellent chemical resistance, being impervious to chlorinated and other solvents, and most acids and alkalies; and (5) excellent flow at injection temperature, the material being fluid enough to flow into thin sections. The speaker noted that nylon has a sharp melting point and does not pass through a mushy stage as do most plastics. The FM-1 grade may drool from the injection nozzle, and a filter pack is needed to prevent such drooling between shots. The filter pack also prevents the passage of unmelted nylon particles which would reduce the toughness of the molded piece. Nylon is quick setting, and temperature control of the mold is needed to prevent premature set-up.

The speaker also discussed some of the other nylon grades, including types suitable for wire insulation and for cements. Applications of the standard grade include shock gears, bearings, grommets, and other products requiring toughness and chemical resistance. Some of the newer developments include nylon sheeting which can be steam sterilized, and colored nylon now available in 16 standard colors. Experimental types under study include a crystal grade and a more heat-resistant grade. Dr. Akin stated that nylon is extending the frontiers of the plastics field by replacing materials in applications hitherto unsuitable for plastic materials. The speaker concluded by showing slides on the chemistry of nylon, properties of the various grades, and some typical applications.

In addition to the principal speaker, an informal talk covering impressions received during a trip to Europe last fall was given by Section member Herbert Proske, Wheelco Instruments Co. Mr. Proske described travel and living conditions in France, Belgium, Holland, Germany, England, Switzerland, Spain, and Portugal.

In the business session preceding the talks, reports were heard from the secretary-treasurer and the various committee chairmen. The idea of having a Christmas Party instead of the regular December meeting was advanced by the program committee and comments were received from the members for action at the next meeting. Table favors were distributed through the courtesy of Arthur S. Jacobs, Renwal Mfg. Co., and the meeting concluded with a drawing for door prizes contributed by Plasticware, Inc., and India RUBBER WORLD.

Panel on Precision Casting

A panel discussion on "Precision Metal Casting Processes" featured the April 7 joint dinner-meeting of the Southern California Section, SPE, and Pacific Coast Section, SPI, at the Officers Club, Los Angeles. Approximately 40 members and guests of the two groups heard the discussion by Phillip Schomer, consultant, Dick Ellis, Dick Ellis Co., and William Rohne, Duncan-Rohne & Co.

The speaker described the "lost-wax" centrifugal casting process for plastic cavity inserts and cores. A metal mold is used to produce wax replicas of the part desired. These wax moldings are then surrounded with a special plaster compound and placed into an oven. The resultant heat melts and removes the wax and also causes the binding agent in the plaster to harden and permit use of the plaster mold for centrifugal casting of molten metal. Advantages of the process were said to be economy and availability of materials, freedom of design, and uniformity. For short runs or for proving designs, such cavities offer the most economical and practical method available. Shrinkages do have to be taken into account, but are easily determined by visual inspection. In addition, the process gives excellent reproduction of irregular parting lines, undercuts, stippling, and lettering. Although steel cavities are being fabricated by this method, the most popular material for casting is beryllium copper because of its thermal conductivity, wear resistance, compressive strength, and corrosion resistance.

The meeting was presided over by John Delmonte, Plastic Industries Technical Institute, and the speakers were introduced by SPE Program Chairman Elbert Davis. A hand drill and screw driver, donated by MacDonald Mfg. Co., was won by Earl Jackson, Ability Products Co.

The two groups also held a dinner-meeting March 3 at Rudi's Italian Inn, Los Angeles, at which two talks were presented: Warren V. Prince, consultant, spoke on "Basic Laws of the Plastic Molding Process"; and Ed Burro, Durez Plastics & Chemicals Co., discussed "Mold Standardization." Mr. Prince's paper tied for third prize in the recent SPE Prize Paper Contest and will appear in a future issue of India RUBBER WORLD.

Mr. Burro emphasized the need of standardization within the plastics industry, particularly for molding techniques. For standardizing flow measurements, Durez has adopted and successfully used ASTM D731-44T. The speaker described this test method in detail and discussed the effects of moisture content, mold pressure, and mold temperature on test results. The use of this flow test for standardizing compression molding procedures was also discussed, together with a recommended molding pressure for high-frequency preheated phenolic materials.

Cox and Warner Speakers at Newark

The Newark Section held its last regular dinner-meeting of the season on April 13 at the Newark Athletic Club. Approximately 85 members and guests heard Clifton Cox, industrial engineer, discuss "Motion Study as Applied to the Plastics Industry," and Frank W. Warner, General Electric Co., speak on "Quality Control."

Mr. Cox's talk, illustrated by motion pictures, emphasized that motion study results in work simplification, which in turn leads to cost reduction. This increases the productivity of available machinery as well as personnel. To succeed in any program of work simplification, a supervisor must create a desire in the worker to do a better job, strengthen the worker's ability, and have authority to take action. All workers, whether laborers, engineers, or executives, are interested in the three S's—Security, Salary, and Standard of Living. They must be sold work simplification on that basis in order to obtain results, the speaker concluded.

Mr. Warner described the factors affecting quality control, using as an example the problems encountered in the manufacture of the M-52 plastic fuze body. The use of quality control principles enabled product and manufacturing engineers to predict how well the molded part would meet specifications and allowed determination of permissible variations between mold cavities. A final product check must also be made of all requirements to insure that the customer receives a finished product of high quality.

In the business session preceding the talks, Section President Harold Frutchey, Thomas Mfg. Co., announced the formation of a three-man finance committee under the chairmanship of Carl Frosch, Bell Telephone Laboratories. There was also a discussion of final arrangements for the Section's annual dinner-dance, to be held on May 13 at the Newark Athletic Club. The next regular meeting has been tentatively planned for September 14.

Plans of Western New York Section

The March 18 meeting of the Western New York Section SPE featured a dinner at the Hour Glass Restaurant, Kenmore, followed by a tour of the Western Electric Co. plant in Kenmore. It was announced that the Section has been admitted to the Technical Society Council of the Niagara Frontier, which permits members to participate in the meetings of all other technical societies in the area. It was also announced that plans for the group's June golf outing are progressing. Niagara Falls will be the host for the outing, and a special dinner has been planned at Liddell's in Lewiston, N. Y. followed by golf at a nearby club.

Melamines for Tableware

The Chicago Section, SPE, and Midwest Chapter, SPI, held another joint dinner-meeting on April 13 at the Builder's Club, Chicago, Ill., with some 75 members and guests of the two sections attending. Featured speaker was William H. McHale, American Cyanamid Co., who discussed "The Use of Melamine Resins in Compression Molded Tableware."

Mr. McHale described the problems involved in introducing melamine tableware, its advantages and disadvantages in comparison with other types of tableware, and the work of setting up standards on melamine tableware by the SPI. Advantages of melamine over urea in tableware include lower water absorption, more pleasing surface, greater heat resistance, higher hardness, and better moldability. When compared to china, melamine tableware shows much less breakage. The greatest disadvantage of melamine tableware is the stain left by coffee, but much progress has been made in the development of suitable detergents to remove such stains. The SPI committee is expected to issue specifications on minimum cure of melamine tableware as tested by boiling water and sulfuric acid; maximum cure as determined by dry heat aging; and minimum thickness of section.

Address New England Section

The Western New England Section held a regular dinner-meeting on April 6 at the Hotel Sheraton, Springfield, Mass. The program comprised two speakers: Islyn Thomas, Thomas Mfg. Co., presented "A Review of Current Plastics Conditions in Europe," and Walter J. A. Connor, U. S. Fibre & Plastics Corp., discussed "Trouble Shooting in Molding Thermoplastics." The talks were similar to those presented by Thomas and Connor at the March 9 meeting of the Newark Section, and reported in our April issue, page 77. The meeting was presided over by President Sherwood Young, Church Mfg. Co., and also included drawings for door prizes contributed by Improved Paper Machinery Corp.

Philadelphia's Public Plastics Show

The Philadelphia Section, in cooperation with Gimbel Brothers of Philadelphia, is sponsoring a Public Plastics Show on May 23 to 28. The Show will be held in Gimbel's Auditorium and will be open to the public in order to educate the public on the plastic materials available for domestic and other uses. There will be about 12 booths set up where plastic items of interest to the housewife and the merchandiser will be on display. In addition, Section members will sponsor a booth to exhibit items from local firms that are too small for elaborate, individual displays. Many of the larger merchandise suppliers are donating materials and personnel to this public education show.

New Developments in Plastics

The Upper Midwest Section held a regular dinner-meeting March 14 at Coffman Memorial Union, University of Minnesota, Minneapolis, Minn. Speaker was T. N. Willcox, General Electric Co., who spoke on "New Developments in Plastics." Mr. Willcox began his talk with a discussion of new developments in automatic compression molding, noting that cycles as low as seven seconds have been achieved in present experimental models. The subject of low-pressure molding using glass fiber preforms was also described together with some of G-E's work in this field. Concluding with a review of nylon extrusion, the speaker emphasized the need of high extrusion temperatures and the extreme difficulty of removing nylon from surfaces to which it happens to stick during the extrusion process.

New Monoplex Plasticizer

MONOPLEX DOA (diisooctyl adipate), a colorless distilled ester of high purity for use as a vinyl plasticizer, has been announced by Rohm & Haas Co., Washington Sq., Philadelphia 5, Pa. The new product is recommended as a primary plasticizer for light-gage film wherein it is said to offer excellent low temperature flexibility, efficiency, hand, and drape; dispersion compounding requiring low initial viscosity, excellent fluxing properties, and good stability; molding and extruding applications; vinyl emulsions; and blends with polymeric plasticizers in both light- and heavy-gage stocks.

Properties of Monoplex DOA follow: APHA color, 75 maximum; acid number, 0.15 maximum; saponification number, 285-295; specific gravity, 0.9250-0.9270; flash point, 390-410° F.; fire point, 440-460° F.; cloud point, below —25° C.; freezing point, —50 to —60° C.; refractive index at 25° C., 1.457-1.459; and dielectric constant at 60 cycles, 4.7. The new plasticizer shows good compatibility with nitrocellulose and ethyl cellulose in addition to vinyl compounds. Like all monomeric esters, Monoplex DOA has a tendency to migrate from vinyl films, but this tendency can be substantially reduced by blending with polymeric plasticizers such as Paraplex G-50.

CALENDAR

May 20.	Chicago Rubber Group. Hotel Morrison, Chicago, Ill.
May 20.	Northern Indiana Section, SPE. Van Orman Hotel, Ft. Wayne, Ind.
May 23-25.	Division of Rubber Chemistry, A. C. S. Hotel Statler, Boston, Mass.
May 23-28.	Public Plastics Show. Gimbel's Auditorium, Philadelphia, Pa.
May 24.	Washington Rubber Group.
May 26.	Northern California Rubber Group.
May 26-27.	Society of the Plastics Industry. Edgewater Beach Hotel, Chicago, Ill.
May 27.	Cleveland Section, SPE.
May 27.	Western New York Section (formerly Buffalo Section), SPE.
June 4.	Southern Ohio Rubber Group. Outing, Edelweiss Park, Dayton, O.
June 7.	The Los Angeles Rubber Group, Inc. Hotel Mayfair, Los Angeles, Calif.
June 10.	Rubber Division, C.I.C. Regional Conference. Royal Connaught Hotel, Hamilton, Ont., Canada.
June 11.	Ontario Rubber Section, C.I.C. Annual Outing and Golf Tournament.
June 13.	Upper Midwest Section, SPE. University of Minnesota, Minneapolis, Minn.
June 14.	New York Section, SPE. Hotel Shelbourne, New York, N. Y.
June 15.	South Texas Section, SPE.
June 16.	New York Rubber Group. Annual Outing. Doerr's Grove, Milburn, N. J.
June 17.	Akron Rubber Group. Summer Outing.
June 17.	Northern Indiana Section, SPE. Van Orman Hotel, Ft. Wayne, Ind.
June 20-25.	Swim for Health Week.
June 23.	Rhode Island Rubber Club. Pawtucket Golf Club.
June 24.	Detroit Rubber & Plastics Group, Inc. Summer Outing.
June 24.	Boston Rubber Group. Summer Outing. United Shoe Country Club, Beverly, Mass.
June 27-July 1.	ASTM. Fifty-Second Annual Meeting. Chalfonte-Haddon Hall, Atlantic City, N. J.
July 30.	Buffalo Rubber Group. Summer Outing, Lancaster Country Club.

Styron Prices Reduced

A REDUCTION of 1¢ a pound in the price of Styron, effective April 12, was announced by Dow Chemical Co., Midland, Mich., through Donald L. Gibb, sales manager of the plastics division. The price reduction, effective for all formulae and colors in quantities of 50,000 pounds or more, indicates the tremendous growth of the plastics industry and the wide use of polystyrene. According to Mr. Gibb, the price change was made possible by the demands of the molding industry for large amounts of single colors and by the action of the National Bureau of Standards in setting up a series of color standards.

To Build Phenol Plant

PLANS for the erection of a phenol producing plant in the Ohio River Valley south of Marietta have been announced by Bakelite Corp., New York 17, N. Y. Construction has not yet begun, but the plant is expected to be in operation late in 1950. The new plant will produce phenol from chlorobenzene under a patent granted to the late L. V. Redman, former company vice president and research director. The plant will be an important part of Bakelite's continuing expansion program that enabled the company to increase average production capacity about 50-60% last year.

New Vinyl Stabilizers

A NEW and complete line of heat and light stabilizers for polyvinyl chloride and associated copolymers is being offered by Ferro Chemical Corp., Bedford, O. Designed for ease of handling and incorporation in plastics processing, the new stabilizers impart excellent clarity and stability to clear stocks at moderate cost, it is claimed. They are equally effective in pigmented stocks and exhibit little or no reaction with pigments. Manufacturers of stocks containing aluminum pigments will be interested to learn that Ferro Stabilizers Nos. 121 and 221 have no detrimental effect on the leafing properties of the pigments. The efficiency of Ferro stabilizers has been thoroughly tested in numerous resin formulations using a wide variety of combinations and concentrations in order to obtain maximum ratios. The results of these tests have been tabulated in charts which are available to resin processors. Many resin processors have already tested the new stabilizers and are using them successfully in production. Samples of the new products and technical literature can be obtained from the company upon request.

Rhode Island Group Meets

THE spring meeting of the Rhode Island Rubber Club took place on April 21 at the Metacomet Golf Club, near East Providence. Approximately 100 members and guests attended the meeting, which included a cocktail hour, dinner, and program of entertainment. Featured speaker was to have been Charles H. Smiley, Brown University, on the subject, "Science and Superstition in Siam." Shortly after starting his talk, Dr. Smiley was taken ill and forced to leave the meeting. The remainder of the meeting went off as planned and was voted a success by the attendance. Among the guests of honor who were introduced were C. W. Christensen, Monsanto Chemical Co., and B. S. Garvey, Sharples Chemicals, Inc., members of the Rubber Division executive committee.

Scientific and Technical Activities

Rubber Division Meeting and High Polymer Forum, C.I.C., June 9 and 10

THE Rubber Chemistry Division of the Canadian Institute of Chemistry will meet on June 10 at the Royal Connaught Hotel, Hamilton, Ont., Canada, according to J. T. Black, Polymer Corp., Ltd., Sarnia, secretary-treasurer of the Division. A program of eight technical papers has been arranged for, and in addition it is planned to hold a dinner the evening of June 10, the guest speaker for which will be announced at a later date.

H. G. Deline, Dunlop Rubber Co., Ltd., Toronto, chairman of the Division, will preside at the meeting and at the dinner. He extends a cordial invitation to American rubber technologists to attend the meeting and the dinner.

A Canadian High Polymer Forum will also be held in Hamilton on June 9 and 10 at McMaster University. According to J. S. Tapp, Polymer Corp., this program will include about ten papers to be presented by workers in university and industrial laboratories in Canada and will be given on the morning and afternoon of June 9 and on the morning of June 10. American visitors will be welcomed, and meals and lodging will be provided at McMaster University. Raymond M. Fuoss, Yale University, will address a dinner-meeting of this group on June 9. His subject will be "Polyelectrolytes." This term has been coined to describe substances of high molecular weight which are at the same time electrolytes. There are the naturally occuring "polyelectrolytes" such as proteins and polysaccharides as well as synthetic materials, of which polyvinylpyridene is an example.

Following both these meetings, on June 11 the annual outing and golf tournament of the Ontario Rubber Section will be held in Hamilton.

Abstracts of Papers, Rubber Division

Plasticity of Reclaimed Rubber. Several well-known methods of measuring plasticity of rubber or rubber compounds have been applied to typical reclaimed rubbers. The change in plasticity of reclaimed rubber with storage has been followed using these methods. At present no single type of plasticity measurement supplies all the information which might be desired on any given reclaim. The selection of a method of measuring plasticity will depend on the processing methods used for the reclaim in question in the consumer's factory. F. L. Kilbourne, Xylos Rubber Co., Akron, O.

Statistical Techniques in the Rubber Industry. When data on processing or on products are subjected to control chart analysis, it is frequently found that excessive variability is associated with one or more influencing variable factors. Suitable corrective measures can be arranged especially if statistical sense is used to buttress "horse-sense." Properly designed experiments help in finding the correct answers, by gathering data suitable for the application of techniques such as correlation and analysis of variance. These methods can be used for interpreting routine data for analyzing special test data and for establishing specifications.

Thus statistical methods provide the means for integrating specifications, production, and inspection into a continuous chain. As better control of product quality is achieved by taking action based on information revealed by inspection data, it is possible to narrow specification limits.

Through selected examples this paper gives a description of how statistics can be used as a basis for action in the rubber industry. It shows how the maximum amount of reliable useful information relating to the influence of variable factors on processes or products may be accumulated with minimum expense. W. H. Schmalz, Dominion Rubber Co., Ltd., Kitchener, Ont.

The Evaluation of Flex-Life and Heat Build-Up Properties of Elastomers. Linear correlations have been established between the state of cure, measured by the dynamic compression of the vulcanizate, and the flex life and heat build-up properties of the vulcanizate.

These properties are measured for an experimental polymer, in the same recipe as that used for the reference polymer, and, by expressing the test value of the experimental polymer as a ratio of the value calculated for the reference polymer, for a vulcanizate of the same dynamic stiffness, independent indices for the two properties may be obtained. On this basis the calculated indices have been found to be independent of the time of cure, and values may be obtained for a limited quantity of an experimental polymer. E. B. Storey, Polymer Corp.

Elongation Hysteresis of *Hevea* and Synthetic Elastomers. A hysteresis test has been developed which measures directly the energy loss per cycle of elongation. Six samples are stretched, like the spokes of a wheel, between a small and a large disk. The latter is motor driven, and the small disk, mounted on a ball bearing, is displaced eccentrically with respect to the larger disk. In the elongation cycle, which each sample undergoes with each revolution, the hysteresis causes an average force on the small disk which is normal to the eccentric displacement and is proportional to the energy loss per cycle. A lever and balance system makes it possible to measure this force continuously while the machine is running.

Measurements were made on gum stocks of *Hevea* and five commercial synthetic elastomers. Testing conditions included temperatures, T, of 0, 35, 70, and 105° C.; frequencies, f, of 5 and 50 c.p.s.; mean elongations, e, of 50, 100, and 200%; and elongation amplitude, A, 25%. Absolute hysteresis, H, (ergs./cycle/centimeter^3/relative amplitude^2), at first decreases with increasing e and then flattens or goes through a minimum. Hysteresis decreases with increasing T. The temperature coefficient between 0 and 35 is very large for Hycar OR synthetic rubber. Hysteresis usually increases with f, but only slightly in most cases; and *Hevea* at e, + 400%, shows a reversal of frequency, which is presumably associated with crystallization effects.

Under the same test conditions the hysteresis of the synthetics is 10 to 20 times that of *Hevea*. When the hysteresis data for all synthetic stocks at various temperatures are plotted against $T - T_s$, T_s being the second-order transition temperature of the respective elastomer, the data lie within a rather narrow band. From this point it is concluded that the hysteresis of synthetic elastomers arises from the same molecular forces which cause hardening and embrittlement at and below T_s. M. Mooney and S. Black, United States Rubber Co., Passaic, N. J.

Some Recent Developments in Special-Purpose Polymers. The following developments in elastomeric polymers are of considerable interest and worthy of review at the present time:

HYCAR P.A. These polymers are a series of polyacrylic esters offered recently by Goodrich Chemical Co. and include polymers similar to Lactoprene EV. They are intermediate between silicone rubbers and other previously available rubbers in heat resistance, but are superior to silicones in physical properties. Some data will be presented showing interesting physical properties of typical compounds. Data will include properties of all polymers in the series, with discussion of advantages and disadvantages of this type of polymer.

BLENDS OF PLASTICS AND RUBBERS. Some new data will be presented on the use of nitrile type rubbers to plasticize phenolic and vinyl resins. Some of the more recent commercial developments such as oleomargarine package material (vinyl-nitrile rubber) and General Electric Co.'s nitrile-rubber modified phenolic molding compound will be discussed.

APPLICATIONS OF NITRILE RUBBER IN THE PAPER INDUSTRY. Data gathered in our laboratories during the past year will be presented with reference to commercial operations. G. W. Flanagan, B. F. Goodrich Chemical Co., Cleveland, O.

Training for More Efficient Engineering and More Productive Supervision. The theme of this talk will deal with and explain the necessity, in both industry and business, of training management personnel. The structure of the talk will cover the basic qualifications for good engineering and productive supervision. Management's responsibility for supplementing these basic qualifications with training for more efficient production and better human relations will be discussed in its many phases.

The major objective of "management training" for supervisory and engineering personnel will be summarized as follows: (1) improved human relations between supervisional, management, engineering, and all other fields. (2) more effective presentation of improved production and engineering ideas; (3) greater recognition of the responsibilities and obligations that must be accepted by both the engineer and the supervisor for the overall success of the organization. D. H. Stevens, Goodyear Tire & Rubber Co. of Canada, Ltd., New Toronto, Ont.

Inadequacy of Laboratory Evaluation of Natural and Synthetic Rubbers. The laboratory testing of natural rubber has long been recognized as giving a not too satisfactory forecast of the usefulness of the rubber. Test methods have been revised, and new ones devised. The trend has, over the years, been toward dynamic

forms of test. The inadequacy of laboratory testing was emphasized by the advent of the GR-S tire. Treads made of this polymer outwore and outperformed any forecast based on their physical properties in comparison with natural rubber. Thus GR-S treads developing tensile strengths of the order of 2,000 to 2,500 p.s.i. gave wear performance 85 to 100% that of natural rubber treads with tensile strengths of the order of 4,000 p.s.i.

In the evaluation of the new low-temperature polymerized GR-S, laboratory tests again failed to predict road performance. Columbian Laboratories decided to go back of the physical test methods and to duplicate, in so far as possible, factory processing conditions. All tread mixing is now done in steam-heated Banbury mixers. A new concept of the mechanism of polymer reinforcement by carbon black is evolving. It is believed that the next revision of laboratory test procedures must start in the mill room. It is quite probable that much time has been wasted on experimental polymers which do not come up to expectancy and that many good polymers have been discarded because their laboratory evaluation did not include a time-temperature history such as they must encounter in the factory. H. A. Braendle, H. C. Steffen, and J. G. Dewender, Columbian Carbon Co., New York, N. Y.

Evaluation of Processability. Laboratory methods of evaluation of factory processability ratings of rubbers are reviewed critically in relation to the current theories of plasticity and elasticity. A method of evaluation based on determination of the magnitudes of the elastic and plastics components of deformation over a range of temperatures is proposed. N. R. Legge and S. T. Einhorn, Polymer Corp.

High Polymer Forum

The titles of the papers to be presented at the Canadian High Polymer Forum, together with the authors and their affiliations follow:

Plant Proteins as High Molecular Weight Compounds. A. G. McCalla, University of Alberta.

Study on the Chemical Reactivity of Cellulose. John Keays, McGill University.

The Degradation of Polystyrene. D. S. Montgomery and C. A. Winkler, McGill U.

The Measurement and Significance of Transfer Constants in Free Radical Polymerization. C. Sivertz, University of Western Ontario.

The Emulsion Polymerization of Isoprene. R. H. Clark, University of British Columbia.

Alkoxy Silicanes and Silicone Resins. A. H. Campbell, Shawinigan Chemicals, Ltd.

The Polymerization of Vinyl Acetate in the Presence of Sodium Perborate. C. Daly, R. Rice, A. C. Cuthbertson, Mount Allison University.

Osmotic Molecular Weights of GR-S Copolymers. D. A. Henderson and N. R. Legge, Polymer Corp.

Houwink and Lockwood at Akron

THE presence of R. Houwink, director of the Rubber Foundation, Delft, Holland, his associate, F. T. Bokma, prominent Dutch road engineer, and Jean LeBras, inspector general of the Institut Français du Caoutchouc, Paris, France, gave an international air to the spring meeting of the Akron Rubber Group, held April 15 at the Mayflower Hotel, Akron; about 300 members and guests attended.

Dr. Houwink described the use of rubber in road construction in Holland. The Dutch roads are constructed with a foundation of coarse stone topped by a finer aggregate, which is covered with a layer of a conventional mixture of fine stone and liquid bitumen. Over this is a surface coat consisting of liquid bitumen, fine finer, and rubber powder to the extent of one-third to one ton of rubber per mile of surfacing material. The rubber adsorbs the volatile constituents of the bitumen, rendering it less soft in the summer and, at the same time, less hard in the winter because of the presence of the swollen rubber. Advantages of the rubber road include a great reduction in maintenance cost, longer lasting road surface, better protection of the road foundation materials, excellent nonskid qualities, greater water resistance, and more dust-free surface. Pictures shown by the speaker of installations in Holland and Java indicated that the rubber road had much greater wear resistance than adjacent control strips containing no rubber.

"The experimental work is now behind us in Europe, and rubber powder is now being specified by highway authorities there on a practical scale," Dr. Houwink stated.

Dr. Houwink was introduced by Warren S. Lockwood, director of the Rubber Development Bureau, who stated that arrangements are being made with state highway departments in Texas, Virginia, and Ohio for installation of test strips of rubber roads, laid under the direct supervision of Mr. Bokma. The program is being undertaken by the three highway departments in cooperation with the Bureau, and the rubber for the test sections is being supplied by the Foundation through the British Rubber Development Board. The first test section is being laid in Texas late in April, the Virginia project will be under way early in May, and work in Ohio will begin late in May. Mr. Lockwood stated that natural rubber producers regard the use of rubber in road construction as the large potential outlet needed to prevent future oversupply, and forecast tremendously expanded use of natural rubber in this country if the performance of test highway sections was to lead to widespread use of rubber in road surfacing.

New officers of the Akron Group were announced at the business session, as follows: chairman, C. A. Ritchie, The B. F. Goodrich Co.; vice chairman, E. L. Stangor, E. I. du Pont de Nemours & Co., Inc.; and secretary, D. F. Behney, Goodyear Tire & Rubber Co. Members also voted in favor of an amendment to the Group's by-laws requiring payment of definite dues as a qualification for membership. W. F. Ayscue, du Pont, general outing chairman, announced that the Group's annual summer outing will be held on June 17 in the Akron area.

Summer Laboratory Courses

THE sixth annual series of Summer Laboratory courses in high polymers has been announced by Polytechnic Institute of Brooklyn, 85 Livingston St., Brooklyn 2, N. Y. Four courses will be given: June 6-17, "Industrial Applications of X-Ray Diffraction"; June 27-July 2, "Advanced X-Ray Diffraction"; June 27-July 1, "Molecular Weight Determination of Polymers"; and July 25-29, "Techniques of Polymerization." Further details may be obtained from Prof. I. Fankuchen, of the Institute.

Raincoat Standards

A MOVE to establish minimum standards of construction and performance of boys' rubber-surfaced raincoats was announced on April 8 by the coated materials division, The Rubber Manufacturers Association, Inc., 444 Madison Ave., New York, N. Y. The recommendations are made by the Association to manufacturers interested in this particular end-use of coated fabrics, according to John P. Hach, division secretary.

The proposed standards grew out of recent work by the division's protective clothing end-use committee and carry the recommendations of the executive committee. Observance of these standards will insure a finished product that will give waterproofness and reasonable wear and should be of interest to manufacturers of raincoats, buying departments, retailers, and consumers.

The recommendations are as follows and represent the minimum in each instance: tensile strength of coated fabric, 25 pounds in either direction; tear resistance, two pounds in either direction; adhesion, five pounds on a two-inch strip; weight of coating, 10±1 ounce per square yard; and hydrostatic resistance, 25 pounds.

Atomic Bomb Discussed

A TALK on "Atomic Energy and the Atomic Bomb," by Robert D. Miller, chief electrical engineer, U. S. Naval Shipyard, San Francisco, Calif., featured the March 31 dinner-meeting of the Northern California Rubber Group, held in the Hotel Claremont, Berkeley. Mr. Miller, an eyewitness at the Bikini tests, gave an interesting talk on the actual explosions, the preceding operations, and the test results. Official Army-Navy color-sound movies of the tests were also shown by the speaker.

A short business meeting was held during the dinner, and entertainment was provided by the Group's barbershop quartet, "The Synthetic Four," composed of Fred Swain, Pioneer Rubber Mills, Don Good, American Rubber Mfg. Co., Wayne Colvin, and Russ Kettering, Oliver Tire & Rubber Co.

The Group's next meeting, on April 28, will feature a talk by F. M. McMillen, Shell Development Co., on "Experiments with the Extension of Cold Rubber by the Use of Plasticizers and Carbon Black." The May 26 meeting will consist of a panel discussion of compounding and processing problems.

"Behind the Iron Curtain"

THE spring meeting of the Philadelphia Rubber Group took place on March 11 at Kugler's Restaurant, Philadelphia, Pa. Approximately 102 members and guests heard a talk by Karl Scholz, professor of economics at the University of Pennsylvania, entitled "A Look behind the Iron Curtain." Dr. Scholz made several trips to Russia prior to the war and spent last summer in Czechoslovakia where he had an opportunity to study at first hand the effects of Communism and Russian influence on that country's economy. Dr. Scholz' talk was followed by a lively discussion period.

Powdered Hycar in Production

COMMERCIAL production of Hycar OR-15 nitrile rubber in powder form, designed especially for mill and Banbury blending with phenolic resins, has been announced by B. F. Goodrich Chemical Co., Rose Bldg., Cleveland 15, O., through J. R. Hoover, vice president—sales. The powdered rubber is the result of a need of a material which could be successfully dry blended and processed in an internal mixer in a minimum operation cycle, Mr. Hoover explained. Hycar powder now makes economically feasible the manufacture of rubber-phenolic molding compounds with exceptionally high impact resistance. Hycar OR-15 powder has also found considerable interest in the blending of petroleum and vegetable resins as shellac replacements, Mr. Hoover further stated.

New Good-Rite Chemicals

The availability in experimental quantities of three new Good-rite chemicals, (benzothiazyl-2)-carboxyethyl sulfide, beta-isothioureido propionic acid, and beta-dithiocarbamylpropionic acid, has been announced also by Goodrich Chemical.

(Benzothiazyl-2)-carboxyethyl sulfide is a light buff-colored material which has low water solubility, a molecular weight of 239, and a melting point of 139-141° C., and can be recrystallized from alcohol. The chemical dissolves readily in sodium hydroxide solutions and is reprecipitated by the addition of acid.

Beta-isothioureido propionic acid can be recrystallized from water and is obtained as a hydrate or in anhydrous form, depending on the drying conditions used. It has a molecular weight of 148, melting point of 178-180° C., and is supplied as a white, crystalline, anhydrous substance.

Beta-dithiocarbamylpropionic acid has low water solubility and can be recrystallized from an ether-petroleum ether solution. It is white, crystalline, has a molecular weight of 165, and a melting point of 124-126° C. The chemical dissolves readily in sodium hydroxide solutions and is reprecipitated by the addition of acid. Its zinc salt, a white solid decomposing at 145° C., reacts with amines to form addition complexes. The ammonium salt is an insoluble white solid melting at 123-125° C.

Blacks for "Cold Rubber"

APPROXIMATELY 160 members and guests of The Los Angeles Rubber Group, Inc., attended a meeting on April 5 at the Hotel Mayfair, Los Angeles, Calif. The afternoon technical session, presided over by Howard Erwin, Goodyear Synthetic Rubber Corp., featured a talk on "New Furnace Blacks for 'Cold Rubbers'" by C. W. Sweitzer, assistant director of research, Columbian Carbon Co.

The development of "cold rubber" concurrently with the development of fine furnace blacks has introduced new compounding problems, Dr. Sweitzer said. Dimensional evaluation of these new blacks is not sufficient to explain their behavior in cold rubber; for example, the irregular modulus behavior of the fine oil HAF blacks cannot be explained on the basis of their structural properties. It has been shown that mixing temperature is a dominant factor in the development of hardness properties in "cold rubber" with these blacks. The HAF blacks are very active in the development of carbon gel, indicated to be the controlling factor in modulus increase, and so require relatively cool temperatures to prevent over-development of carbon gel and avoid processing and scorch difficulties.

The speaker noted that the fine natural gas VFF blacks are less active in carbon gel development and so can be safely processed at the high-speed mixing temperatures commonly used with standard GR-S. When processed to assure adequate carbon gel development, the VFF blacks give modulus, abrasion, and road wear results fully equal to those of the HAF blacks, plus, increased elongation which assures maximum resistance to flex cracking and aging. The activity of the HAF blacks is tentatively ascribed to a greater avidity for oxygen as shown in oxidation tests with the loose carbons and tread stocks, Dr. Sweitzer stated.

A cocktail hour and dinner followed the technical session. Brigadier General Leroy H. Watson, originally scheduled to address the dinner-meeting, was unable to attend, and the members were entertained instead with an exhibition by Dr. Giovanni, pickpocket extraordinary. There was also a showing of the film, "One for the Books," reviewing the 1948-49 season of the Los Angeles "Dons" football team. Drawings for door prizes donated by the Group were won by Ed Wolson, Golden State Rubber Mills; Joe Sheets, H. M. Royal, Inc.; Phil Drew, Goodyear Tire & Rubber Co.; Ray Green, Green's, Inc.; Jack Bain, L. H. Butcher Co.; Chuck Ogden, E. I. du Pont de Nemours & Co., Inc.; and Bill Haney, Kirkhill Rubber Co. Low-pressure tire gages, donated by A. Schrader's Son Division, Scovill Mfg. Corp., were won by John MacDowell, Patterson-Ballagh Corp.; Lou Kotich, Ohio Rubber Co.; Bill Michalak and Harold Calkin, both of Kirkhill Rubber; Joe Hanson, Caram Mfg. Co.; and D. W. Burson, H. M. Royal, Inc.

Hear Brandt and Dudley

SOME 115 members and guests of the Chicago Rubber Group attended a meeting on March 25 at the Morrison Hotel, Chicago, Ill. Two talks were presented at the afternoon technical session: Allyn I. Brandt, general sales manager, B. F. Goodrich Chemical Co., spoke on "Selling to the Rubber Industry—Then and Now", and John C. Dudley, assisted by John Simpson, both of Chrysler Corp., discussed "Automotive Mechanical Goods."

Mr. Brandt described the early days of selling to the rubber industry when secrecy was the watchword and little information was available to the supplier on how his product was used in the rubber plant. At that time suppliers furnished very little technical service or data, but in the 1930's the practice of furnishing compounding information was begun and expanded steadily until the beginning of World War II. With the advent of synthetic rubber it became necessary for suppliers to test their products in each synthetic and get the resultant data into the hands of the rubber compounder as quickly as possible. Thus was built up the system of technical service information which is today the best and most complete of any furnished by suppliers to an American industry. While it can be expected that the amount of technical service will be decreased in the future, enough will always be available to satisfy the needs of the rubber industry, Mr. Brandt concluded.

Mr. Dudley stated that the importance of the automotive industry to the economy of the rubber industry is evidenced by the fact that about 75% of the rubber industry's output goes into the auto industry. Half of this volume goes into tires and tubes, and the other half comprises the 375-odd mechanical parts which go to make up the modern automobile. Chrysler lists 91 companies as sources for non-oil resistant rubber parts, 75 for oil resistant parts, and 39 for plastics parts. Some of the main uses for mechanical rubber parts are for shock and vibration dampers, sealers to exclude dirt and fluids, and parts to carry and distribute loads. The automotive industry takes advantage of almost every important property it is possible to design into a rubber product, but is also the leader in requiring special properties for special uses. The auto manufacturer therefore finds it necessary to design special machines to test these properties. In this connection cooperation between rubber technicians and automotive engineers is very valuable and should be expanded, Mr. Dudley noted the need of improvement in seat construction, windshield wipers, flexible couplings, isolation of noise and vibration, and sealing, and the need of more engineering data on the use of rubber.

A social hour and dinner followed the technical session. After dinner William Gilman, Brown Co., spoke briefly on life in logging camps and showed a sound-color film, "King Spruce," depicting logging operations and the preparation of pulpwood.

Wicket on Radio Isotopes

A TALK on "Application of Radio Isotopes to Industry," by W. A. Wicket, Tracerlab, Inc., featured the March 31 meeting of the Gates Technical Club. About 90 members and guests of the group attended the meeting, which included a cocktail hour and dinner, held at Cunningham's Restaurant, Denver, Colo.

Mr. Wicket described many uses for tracer elements in physiological applications, to measure reaction rates, and to determine the degree of dispersion of one compound in another material. The discussion included explanations of alpha, beta, and gamma particles and their effects in various applications.

The meeting also included a showing of the film, "Westward Course of Empire," depicting opportunities in the area for industrial enterprise. The business session included reports by the group's treasurer and athletic committee chairman.

Robert Jaeger has joined the sales department of Sid Richardson Carbon Co., Fort Worth, Tex. He will headquarter at the company's division office at 335 S. Main St., Akron, O. For the past three years he was sales manager for The C. P. Hall Co. and for 16 years before that was a member of the technical and lubricating sales department of the Standard Oil Co. of Indiana. Mr. Jaeger is also well known as the author of several papers on industrial processing and for some patent work on rubber reclaiming.

RUBBER WORLD
NEWS of the MONTH

Study Group Estimates 1949 World Rubber Consumption 1,900,000 Tons; RFC Submits Synthetic Plant Disposal Plan

The Rubber Study Group meeting in London, England, during the week beginning March 28 was featured by the official estimate that world rubber consumption during 1949 would again reach 1,900,000 long tons. Natural rubber production was estimated at 1,575,000 tons. Natural rubber producers learned from American and Canadian representatives that the consumption of synthetic rubber on the North American continent in amounts between 250,000 and 500,000 tons a year was likely to continue for some time to come on a voluntary basis even though mandatory consumption was no longer in effect. The RFC report on plans for the disposal of government-owned synthetic plants was submitted to the President and the Congress on April 1, as required by Public Law 469. It was recommended that legislation be passed to permit the disposal of the plants at a "fair value" based on replacement cost arrived at by a current appraisal of the facility in question with due regard given to security considerations. Purchase may be effected by a down payment of 20%, and the balance distributed over a 10-year period adjusted to actual production during that period. Statements by industry executives continued optimistic for 1949 production and sales of rubber goods at a level about equal to that of 1948. Opposition to the fourth-round wage increase demand of the URWA was voiced by management. It was indicated that wage increases at this time might result in business setbacks since higher wage costs cannot now be balanced by higher selling prices.

London Rubber Study Group Meeting

According to reports from various sources, the Rubber Study Group meeting in London the week of March 28, included statements by various national delegations on such things as the recent advances in the synthetic rubber industry in the United States, the present economic position of the producers of natural rubber and social conditions in their countries, the grading and packing of natural rubber, and the costs and prices of both types of rubber.

The United States Department of State in a release dated April 5, 1949, said that it had received word that the sixth meeting of the Rubber Study Group, held under the chairmanship of Sir Gerard Clauson, Assistant Under Secretary of State, Colonial Office, ended on April 1. The vice chairmen were A. Pirelli, of the Italian delegation, and M. W. A. David, of the Liberian delegation.

The meeting was attended by delegations from Australia, Belgium, the British Colonies, Burma, Canada, Ceylon, Czechoslovakia, Denmark, France, Hungary, Italy, Liberia, the Netherlands and Indonesia, the United Kingdom, and the United States, and by observers from the United Nations (Interim Coordinating Committee for International Commodity Arrangements) and from the International Rubber Development Committee. A representative of Siam was also present. Donald D. Kennedy, chief, International Resources Division, Department of State, was chairman of the United States delegation, other members and advisers of which were listed last month.

The principal objects of the meeting were given as : (1) to examine the statistical position regarding the production and the consumption of rubber throughout the world; (2) to review the world rubber situation in the light of the changes in that position since the fifth Study Group meeting in Washington, April, 1948; (3) to consider measures designed to expand world consumption of rubber.

The Group examined the statistical position, and it was estimated that the world production of natural rubber would be about 1,575,000 long tons; while consumption of natural and synthetic rubber might amount to 1,450,000 and 450,000 long tons, respectively.

Estimated natural rubber production in 1949 (in 1,000 long tons) for principal producing territories was given as follows:

Territory	Production
Malaya	700
Indonesia	500
Ceylon	90
Indo-China	45
British Borneo	62
Burma	12
Liberia	27
Other countries	139
Total	1,575

Estimated natural and synthetic rubber consumption in 1949 (in 1,000 long tons) for principal consuming territories was indicated as:

Territory	Natural	Synthetic*	Total
U. S. A.	600	410	1,010
U. K.	183	2	185
France	97	8	105
Netherlands	10	†	10
Belgium	15	†	15
Czechoslovakia	30	...	30
Italy	33	3	36
Denmark	5	†	5
Hungary	3	...	3
Australia	30	†	30
Canada	40	20	60
Other countries	404	7	411
Total	1,450	450	1,900

*Excluding Russian-produced synthetic rubber.
† A small amount is expected to be used.

The above figures make no allowance for governmental stockpiling, but it will be noticed that there is a possible surplus of 125,000 tons of natural rubber production over consumption that might be used for this purpose.

The Group continued its policy of examining all possible means for encouraging the expansion of the world consumption of rubber. It was recognized that much valuable development work on existing rubber products was being done throughout the world, and the Group considered that the most immediate large-scale increase in the consumption of rubber would be achieved by an intensification of this work, particularly in certain fields.

The Group emphasized the great importance which it attached to the speedy application of the results of research in new uses of rubber. In this connection the Group paid a tribute to the work of the International Rubber Development Committee and invited the Committee to continue to send observers to its meetings.

The Group was informed of the intention of the French producers to grade and market their rubber on its intrinsic properties (to be known as specification rubber) as well as on external appearance.

The Rubber Study Group will hold its next meeting some time during the second quarter of 1950, the precise date and the place to be decided by the management committee, the State Department release concluded.

It is understood that the American delegation devoted the majority of the time allotted to it to a thorough discussion of production, consumption, and the latest developments in synthetic rubber in the United States. The point was made that mandatory consumption of synthetic rubber in 1948, which was set at about 240,000 long tons, was exceeded by more than 160,000 tons of voluntary consumption. A proven market for the regular commercial grade of GR-S and Butyl rubber therefore exists in the United States, even if mandatory consumption was no longer required, and this fact together with the development of "cold rubber" makes it appear likely that at least 200,000 tons of synthetic rubber will be consumed in the United States for some time to come.

The Canadian delegation also pointed out that synthetic rubber is now a definite part of the Canadian economy. They mentioned their exports of synthetic rubber to Europe as an indication of their belief in the future of synthetic rubber.

William O'Neil, chairman of the board and president of The General Tire & Rubber Co., in a report made after his return to the United States after attending the Study Group meeting, stated that the natural rubber growers, mainly those from the Far East, were amazed that the future for synthetic rubber looked so bright.

"It was our position to show how synthetic rubber complemented rather than hurt the position of natural rubber," Mr. O'Neil pointed out. "We explained that more than a million tons of rubber were used in American manufacturing last year. Of this total rubber used, about 600,000 tons were natural rubber—or approximately the same amount as needed by the industry in prewar years."

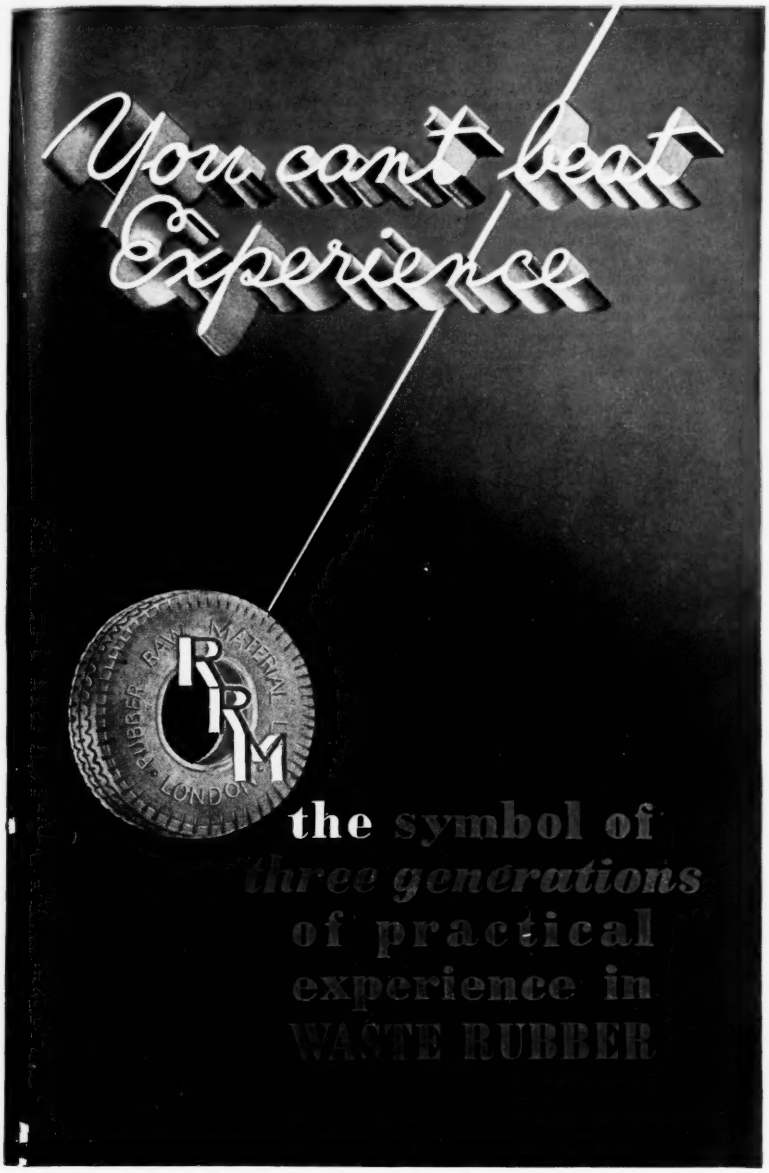
"We have found that there are certain things synthetic rubber does much better than natural rubber," the General president said. "We are continually finding new uses for rubber—and naturally the requirements will be greater. I think there is a place in our industry for both man-made and tree-grown rubber."

Faced with increasing labor costs, the growers are seeking an increased price for their rubber.

"We were assured of a better quality of rubber by the growers," Mr. O'Neil continued. "They insist extensive study has been made, and is being made in processing, warehousing, and shipping rubber."

A Reuters dispatch from London, dated April 1, indicated that moves by Malaya, Ceylon, and other producer countries to raise the price of rubber may follow the Study Group meeting.

Ceylon's representative, V. Coomara-



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swamy, said they had pressed forward the case for a more economic price for rubber, which he said was little more than the production cost.

"But the United States," he added, "holds the key as the biggest consumer. No concrete result has been achieved by the conference, which is advisory. If nothing comes of our efforts to raise the price, producer countries will have to consider combining together to see what can be done.

"If the price remains as it is, it can only lead to economic deterioration, and the political situation will become more and more upset."

Sir Gerard Clauson, who also headed the British colonial delegation, indicated that there had been "no serious discussion" about the necessity of a restrictive international agreement on rubber.

A *New York Times* report datelined Amsterdam, April 17, by Paul Catz, stated that Dutch rubber quarters in that city gave it as their view that the Study Group conference in London was "a complete washout."

The price for rubber, according to the Dutch producers, is decidedly too low, especially for holders of small plantations. The latter in many instances throughout Southeast Asia have given up their rice fields and are now entirely dependent on rubber and have to buy rice at exorbitant prices. A shortage of rice for several years has been predicted, and this, according to the rubber producers, will create serious dangers which menace not only the rubber interests themselves, but also all those millions of persons in Southeast Asia who directly or indirectly are dependent on rubber.

Dutch and other rubber producers were dumbfounded that in view of the aims of study groups, the rubber group confined itself to "listening to some national statements" instead of tackling the price problem. They particularly asked whether the attitude of some members of the American delegation was in line with the principles of the ITO charter and President Truman's Point 4.

Finally the Dutch growers held that a solution of the price problem could easily be found by America holding strictly to the 220,000 tons of synthetic rubber provided in the Shafer Bill (Public Law 469) instead of the present 450,000-ton output because such curtailment would cause a slight shortage of natural rubber which would automatically tend to raise prices.

World production of natural rubber in February is estimated by the Secretariat of the Rubber Study Group at 97,500 long tons, a drop from the 125,000 tons produced in January, the U. S. Department of Commerce reported on April 12. February output was below that in February a year ago (100,000 tons) and was the lowest figure since August 1947, when 95,000 tons were produced.

World output of synthetic rubber, excluding Russia, is estimated at 40,000 tons in February, compared with 42,500 tons in January and 43,000 tons in February, 1948.

Consumption of natural rubber is estimated at 112,500 tons in February, exceeding production by 15,000 tons; January consumption was placed at 127,500 tons, and that for February at 102,500 tons. February consumption of synthetic rubber is estimated at 37,500 tons, against 40,000 tons in January and in February, 1948.

Munitions Board Stockpile Report

"Industry Report—Rubber" of the Department of Commerce, Rubber Division, for March, includes some interesting comments on the Munitions Board report to Congress of January 23.

At the close of the calendar year 1948 the entire $800,000,000 authorized by Congress in cash and contract authority had been spent, committed, or earmarked for pending contracts. Budget Bureau deficit appropriation recommendations to Congress in early March included $40,000,000 for additional stockpiling of strategic materials to June 30, 1949.

The report states that rotation of stocks of perishable materials, including rubber, will continue to grow in importance as an administrative detail. In this connection rubber dealers have urged that a New York sample room be established, where samples of lots for sale can be inspected and bids made without the expense, time, and trouble of visiting widespread depots and inspecting the actual rubber for each transaction. Rotation of strategic stocks will mean long-term government participation in the rubber business. Suitable storage space for rubber is stated to be increasingly difficult to find in government depots in northern climates, as large floor areas per ton of material are required, and it shortly may prove necessary to contract for commercial storage space. These are hints that the expense of storage and rotation are beginning to command attention.

Economic and prudent buying is attempted at all times, according to the Munitions Board report. The policy has been successfully followed of never paying above the market price for materials, insuring that the investment will remain sound, and obtaining the largest possible quantity of material for each expenditure. It is indicated that in the case of rubber it is more advantageous and inexpensive to buy future than spot supplies. The buying of materials for delivery six to 12 months in the future is said to involve the commitments of large sums of money for long periods. Obviously it also involves contracts for definite quantities of rubber so far ahead (when supplies might fall short of estimates) that ample stocks of GR-S are needed to assure rubber for industry use at all times, Commerce Department comment adds.

RFC Synthetic Plant Disposal Plan

A report, developed in compliance with the Rubber Act of 1948 requirement for a plan for the disposition of government rubber-producing facilities to private ownership, was submitted to the President and Congress on April 1 by Harley Hise, chairman of the board, Reconstruction Finance Corp. The program was formulated with the assistance and cooperation of other government agencies and the rubber, petroleum, and chemical industries.

The full title of the report is given as: "Report with Respect to the Development of a Program for Disposal of the Government-Owned Rubber-Producing Facilities," Reconstruction Finance Corp., April 1, 1949. It is obtainable from the Government Printing Office, Washington, D. C.

The report consists of five parts, the transmittal letter, and six appendices. Of the five major parts, the first is a summary; the second outlines the procedure followed by the RFC in developing this disposal program; the third sets forth the principles essential to both the development and the execution of the disposal program; the fourth presents the disposal program recommended, and the fifth refers to legislation required for the implementation of the proposed program.

Salient features of the proposed disposal program which will probably be included in the legislation to be submitted to Congress in January, 1950, follow:

(1) Within 30 days after its designation by the President, the Disposal Agency should publicly announce its readiness to receive proposals and proceed with negotiations for the sale or lease of synthetic rubber-producing facilities.

(2) At a definite date to be announced by the Disposal Agency, but not less than six months after the agency has announced its readiness to receive proposals, possession of all facilities for which negotiations have been completed shall be granted.

(3) Sales price of the plants is to be based on replacement cost based on an appraisal made by a competent engineering organization and with due regard given to security considerations.

(4) Four possible types of sales contracts are considered, but the proposed function-use contract is described in considerable detail. The particular contract provides for a 20% down payment and the balance distributed over a 10-year period adjusted to actual production experienced during that period.

(5) The government will continue to do research and development work on synthetic rubber, and in this connection the government-owned pilot-plant and laboratory facilities located in Akron, O., should be maintained for the foreseeable future and the results of government research made available to operators of private and government operated plants.

(6) Plants may be leased instead of purchased, but leases should be at less advantageous terms to the lessee than terms of sale.

(7) Whether or not mandatory usage of synthetic rubber is continued is left up to the President, but it is indicated that such usage may be necessary for security reasons.

(8) After the transfer of facilities has begun, the government should progressively cease the manufacture of synthetic rubber in relation to the quantity produced by private industry, but the government shall, however, provide synthetic rubber for mandatory requirements and to the extent practicable for voluntary requirements whenever the demand cannot be met by the facilities transferred.

(9) If small consumers are unable to make satisfactory arrangements to obtain synthetic rubber for mandatory use, the government should be authorized to intervene and upon reasonable notice to the producer direct the delivery to consumers of such materials at a price which the government considers fair and equitable on the basis of relevant factors.

(10) Facilities which constitute the plant capacity required for national security and not sold to private industry should be maintained by the government in such condition that in the event of a national emergency the facilities may be reactivated within a minimum time. These facilities should include at least one alcohol butadiene plant.

In addition to the points listed above certain other paragraphs in the report are of special interest.

"When any industry, large or small, has been developed to a point where a reasonable position in our economy can be maintained, irrespective of any known competitive force, it may be considered a sound industry. There is little doubt that some portion of the synthetic rubber industry as it exists today has attained this firm competitive position in the use field of rubber hydrocarbons. It is doubtful, however, if the industry as a whole has attained

THE STORY BEHIND THE WORD...

BOYCOTT...

The word boycott comes from the days when Ireland was struggling against a system of absentee landlordism. Captain James Boycott, an agent for an English landlord, was especially unpopular because of his harsh treatment of the peasants. They pleaded for his removal but the landlord refused. In retaliation, the Irish refused to have any dealings at all with Boycott. From that time, we have called this system of social sanctions—"boycotting."

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the position which would satisfy the minimum requirements set forth in the Rubber Act of 1948 as necessary for national security requirements. Industry representatives confirm this doubt, as indicated in the reports submitted by the rubber industry and petroleum-chemical advisory committees.

"National security considerations may restrict the free use of synthetic rubber facilities after disposal. The degree to which security requirements or restrictions on the use of facilities may either increase or decrease the value of the facilities for use by private enterprise cannot be accurately determined in advance.

"National security considerations have dominated the thinking in the development of the disposal program. Since it is impossible to forecast the requirements of national security over the reasonable life of a facility, it is impracticable to rely upon the commonly accepted economic approach, predicated upon the profit incentive, in determining the value of facilities for the purpose of disposal.

"Nor is it possible, under the circumstances, to appraise from the operation of normal economic forces the extent to which private enterprise might invest in the government-owned facilities on a basis comparable to the cost of new facilities, if the government facilities were available without any security restraints. The worth of the facilities, however, should not be 'written off' because of unpredictable effects of security restrictions, nor because of the newness of the industry. The existence of this new industry assures rubber fabricators in the United States of adequate and available supplies of basic raw material of uniform quality. Development of the synthetic rubber industry has contributed to the stabilization of rubber prices, and also has made possible, in many instances, better end-products than formerly were produced. These advantages to the rubber fabricating industry must be given due consideration in evaluating the rubber-producing facilities."

Appendix A of the report gives the membership of the Inter-Agency Disposal Committee, the Rubber Industry Advisory Committee, and the Petroleum-Chemical Industry Advisory Committee.

Appendix B includes the report of the Rubber Industry Advisory Committee regarding the disposal program and, as Exhibit A, a letter by P. W. Litchfield, Goodyear Tire & Rubber Co., chairman of the Committee, asking for comments and suggestions from 400 manufacturers of rubber products with regard to the development of the disposal program. Only 14 replies to this letter were received from those who were not members of the Rubber Advisory Committee.

Appendix C presents the "Suggested Plan for Disposal of Government Synthetic Rubber-Producing Facilities by the Petroleum-Chemical Advisory Committee."

Appendix D has the title, "Government Synthetic Rubber Program—Summary of Plants by Status," and provides information on active and standby copolymer, GR-I, GR-M, butadiene, styrene, and other plants, with special reference to "rated" and "demonstrated" capacity.

Appendix E gives government investment in synthetic rubber plants; while Appendix F provides an operating and financial summary of the synthetic rubber program.

Lockwood's *Rubber Report* for April 15 in commenting on the operations statement of the RFC for the fiscal year ended June 30, 1948, has listed the following approximate figures for GR-S. Such items as rental income, revenue from tank-car operations, profit from sale of chemicals, and other income, were eliminated from the "Income" listing and excess of sales freight, loss on property disposals, and contract termination expense, were eliminated from "Operating Costs and Expenses."

Income		¢ per Lb.
Sales of synthetic rubber (GR-S—370,000 tons)	$153,000,000	18.5
Cost and Expense		
Cost of goods sold	$115,000,000	13.9
Depreciation	25,000,000	3.0
Research, storage and handling, other	3,000,000	.4
Interest	3,000,000	.4
Total		17.7
Balance available	7,000,000	.8
	153,000,000	18.5

On this basis, it is indicated that the operations have not been at a loss, but have returned a small profit.

Industry Trends

James J. Newman, vice president in charge of sales for The B. F. Goodrich Co., stated in New York on March 31 that the lowest point of the year in tire sales has definitely passed, and his company sees no reason why it should change earlier 1949 total sales estimates of 85,000,000 tires for the country as a whole. He emphasized that the factor which has the most bearing on the number of tires sold throughout the country is the total number of two-year-old or older automobiles in use. This year more than 30,800,000 such cars and trucks will be in use, an increase between 800,000 and 900,000 over the 29,900,000 in use last year.

In addition, total truck tire requirements are continuing to expand, Mr. Newman pointed out. The constantly increasing freight tonnages moved on trucks require constantly larger quantities of truck tires. As a result, Goodrich executives still think more tires will be sold this year than last year.

Howard N. Hawkes, assistant general manager of United States Rubber Co.'s tire division, on April 15 predicted that automobile tire replacement sales for the next six months would be at a higher level than in 1948 because of the prospect of a record season of motoring. The industry, he said, will sell about 25,800,000 passenger-car tires for replacement during the peak six-month period of April-September, inclusive, compared with 25,400,000 units for the same period last year. Truck tire replacement sales are also expected to exceed those of last year, with an estimated 4,400,000 for April-September of this year, as against 4,189,000 in 1948 for a like period.

He explained that two factors determined tire demand: one, the number of vehicles in operation, and, two, the total mileage traveled by these vehicles. Thus, with the expectation of nearly 40,000,000 vehicles on the road before the end of the year and with greater gasoline consumption, tire mileage will be correspondingly high.

Mr. Hawkes predicted production of the tire industry this year at about 81,750,000 units, including passenger, bus and truck, and farm types. Of these, 63,750,000 will be passenger tires, 13,000,000 bus and truck, and 5,000,000 farm tires of all types. These figures include tires for both domestic and export use.

Herbert E. Smith, chairman of the board, U. S. Rubber, told stockholders at the company's annual meeting on April 19 that the business outlook for 1949 is favorable. He reported that sales in the first quarter were off 7% from the same period last year, but that they had showed improvement in February and March after a sharp drop in January.

"Historically, our sales show considerable improvement in the second over the first quarter of the year. We expect this to be the pattern this year," Mr. Smith added.

Reviewing the company's progress in the past 10 years, he revealed that although income taxes had increased five-fold, employes' pay had risen 3½ times, sales had almost tripled, and earnings had only doubled.

"If the American system of private enterprise is to survive, the public and the government must be made to understand that fair profits are necessary to induce people to save, and to invest their savings in the tools of production," Mr. Smith explained. "From better tools of production comes a better standard of living."

John L. Collyer, president of the Goodrich company, also on April 19, told stockholders of that company at their annual meeting that sales for the first quarter of 1949 were about 1% under the first quarter of last year. Net income was lower due to higher costs and lower selling prices.

"The backlog demand accumulated during the war years has now been satisfied. In the future, industry sales of rubber products will largely depend on current needs for tires and other rubber products, and on the development of new products in which rubber is a vital component," Mr. Collyer declared. "Replacement tire needs will be much higher than before the war due to the increase in the number of vehicles in operation, and sales of original equipment tires will be keyed to the level of production of new vehicles."

According to other reports, business in the mechanical goods field, considered a good barometer of industrial business health, is still strong although order backlogs are gradually being whittled down. This field includes belting and hose and miscellaneous molded goods.

Foam rubber production is growing; both Goodyear and the Firestone Tire & Rubber Co. have expanded production facilities, and it is understood that other large and medium-size companies have similar plans. Cushioning for passenger cars, buses, and airplanes is still the predominant market for foam rubber though its use is expected to grow in furniture and mattresses.

Sole and heel production for the first quarter of 1949 reflected the leveling down trend in the shoe manufacturing industry. Despite a slow first quarter, a shoe production of 440,000,000 pairs is predicted for 1949. This represents a normal leveling off from the 1948 figure of 462,000,000 pairs. Also, a production of 440,000,000 pairs this year seems to be a reasonable expectation in view of an approximate 10% increase in population over prewar, when shoe production had reached a total of 400,000,000 pairs a year, India Rubber World is advised.

It is pertinent to note, particularly from the point of view of the sole and heel industry, that 40% of shoes now being made carry bottom material other than leather. It has been reliably reported that some shoe factories have run as high as 48% non-leather bottoms.

Our adviser adds that the sole and heel industry realizes full well the necessity of and the responsibility for preserving this hard-won position in the present shoe economy. Every effort will be exerted to maintain the high quality consistent with and necessary for adequate service.

Every effort, furthermore, is being made to raise the quality standards and prestige of the shoe repairing industry, by collaborating in development of new and improved methods, further by helping to secure for

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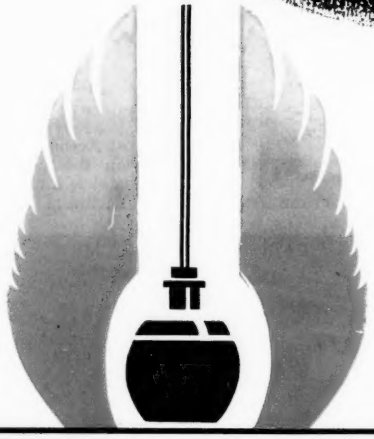

Since 1925 The C. P. Hall Co. has supplied the rubber industry with PARA-FLUX.® Many substitutes have appeared on the market since that time, but PARA-FLUX® continues to be the standard softener and plasticizer for the rubber industry.

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CHEMICAL MANUFACTURERS

AKRON, OHIO
LOS ANGELES, CALIFORNIA
CHICAGO, ILLINOIS
SAN FRANCISCO, CALIFORNIA

this industry well-merited public recognition of its great importance in our national economy.

Shoe repairing and the corresponding use of replacement rubber soles and heels were not up to expectation for the first quarter. Except for the possible effect of heavy clearance sales of surplus shoes at low prices, the reason for this decline is not known.

The report on tires and tubes, issued April 15 by The Rubber Manufacturers Association, Inc., stated that manufacturers' shipments of passenger-car tires in February declined 7.4% to 3,936,490 from 4,249,036 during January. Production of passenger tires was up slightly to 4,782,570 from the 4,772,116 manufactured in January. As a result, inventories at the end of February totaled 10,180,057 tires, against 9,319,292 at the end of the previous month.

Shipments of truck and bus tires in February amounted to 928,979 units, a decline of 10.4% from January when 1,036,367 units were shipped. Production was slightly lower at 1,108,262 units, against 1,123,820 for the previous month; and inventories therefore rose to 2,205,302 units from the 2,020,154 on January 31.

Shipments of automotive tubes were lower in February, 4,404,001 units against 4,925,547 in January, while production of 4,921,766 tubes compared with 5,062,357 for the previous month. Stocks were up about 6% to 10,442,118 from the 9,814,837 tubes on hand at the end of January.

The Department of Commerce reported on April 14 that the value of United States exports of rubber and rubber products in February amounted to $9,524,466, compared with $11,283,431 in January and $12,916,711 in February, 1948.

Analysis of Bureau of Census figures by the Rubber Division, Office of Domestic Commerce, indicates that February shipments showed declines in most categories from the January figures. Heaviest declines were registered by passenger-car and truck and bus tires and by scrap and synthetic rubber. Shipments of farm tractor and implement tires, however, increased from $224,222 to $411,733, and shipments of off-the-road tires increased from $203,932 to $353,292.

New Latex Distributors, Inc., Plant at Baltimore, Md.: (A) Laboratory and Office in Foreground, Plant in Rear; (B) View of Plant Interior

Value of exports during the first two months of 1949 was $20,807,897, a decline of 16.1% from the $24,812,146 reported for the first two months of 1948. Mechanical rubber goods and passenger-car, truck and bus tires were responsible for the major part of this decline.

The RMA report on rubber consumption for March gave a figure of 90,878 long tons of new rubber consumed, 12.4% above the February consumption of 80,853 tons. The use of natural rubber increased 13.3% during March to 52,280 tons from 46,157 tons in the previous month. Consumption of synthetic rubber increased 11.3% to 38,598 tons from 34,696 tons in February.

By types, synthetic rubber consumption for March was as follows: GR-S, 29,738 tons; neoprene, 3,102 tons; Butyl, 5,298 tons; and nitrile types, 460 tons.

Industrial Relations News

The United Rubber Workers of America, CIO, indicated intention of asking for a 25¢-an-hour wage increase and a company-paid pension plan of $100 a month for its members is likely to run into opposition from rubber company management, according to J. W. Keener, Goodrich vice president. Speaking before a meeting of the American Management Association in New York last month, Mr. Keener called attention to the decline in the cost-of-living index during the past several months to substantiate his claim that the union has no justification for asking for a wage increase at this time.

"The cost-of-living index has declined 3% since September, 1948, and is now at or below the level that existed in the Spring of 1948 when the third round of wage increases was made," Mr. Keener said.

He added that the economic and political climates in which 1949 negotiations will be conducted are considerably different from those affecting collective bargaining in the past three years. Higher production costs occasioned by wage increases cannot now be offset by higher selling prices as in 1946, 1947, and 1948. Lower volume, lower prices, and higher costs are reflecting themselves in lower profit margins and in losses.

"Future wages must come from future sales and not from past profits. A fallacy widely publicized by many unions is that purchasing power can be maintained or increased only through wage increases," Mr. Keener continued.

"Purchasing power can be more soundly maintained or increased by reducing costs and prices so that a dollar will buy six loaves of bread instead of five. Purchasing power will rise as the cost of living decreases."

Mr. Keener warned that wage increases at this time may precipitate a serious business decline and depression. This is the fourth time since V-J Day that mass production industries have had occasion to consider wage increases, he added.

"This is, by all odds, the most crucial of all because of the possible results in promoting moderate readjustment and stability, or in precipitating a serious business decline and depression.

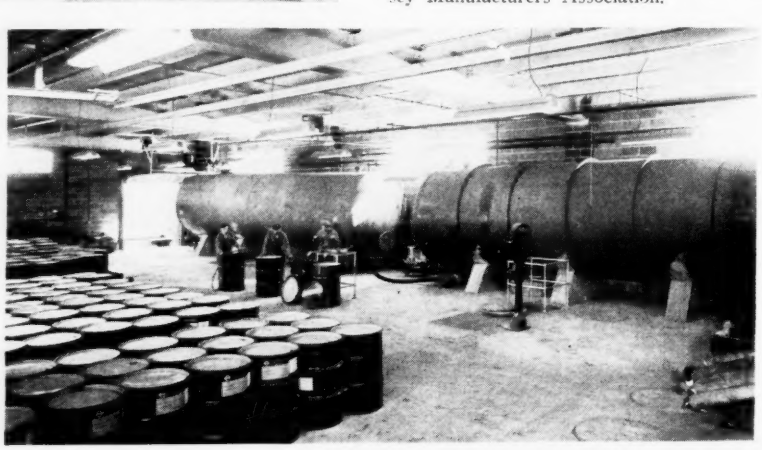
"It is a time that calls for statesmanship on the part of business and on the part of union leaders," Mr. Keener concluded.

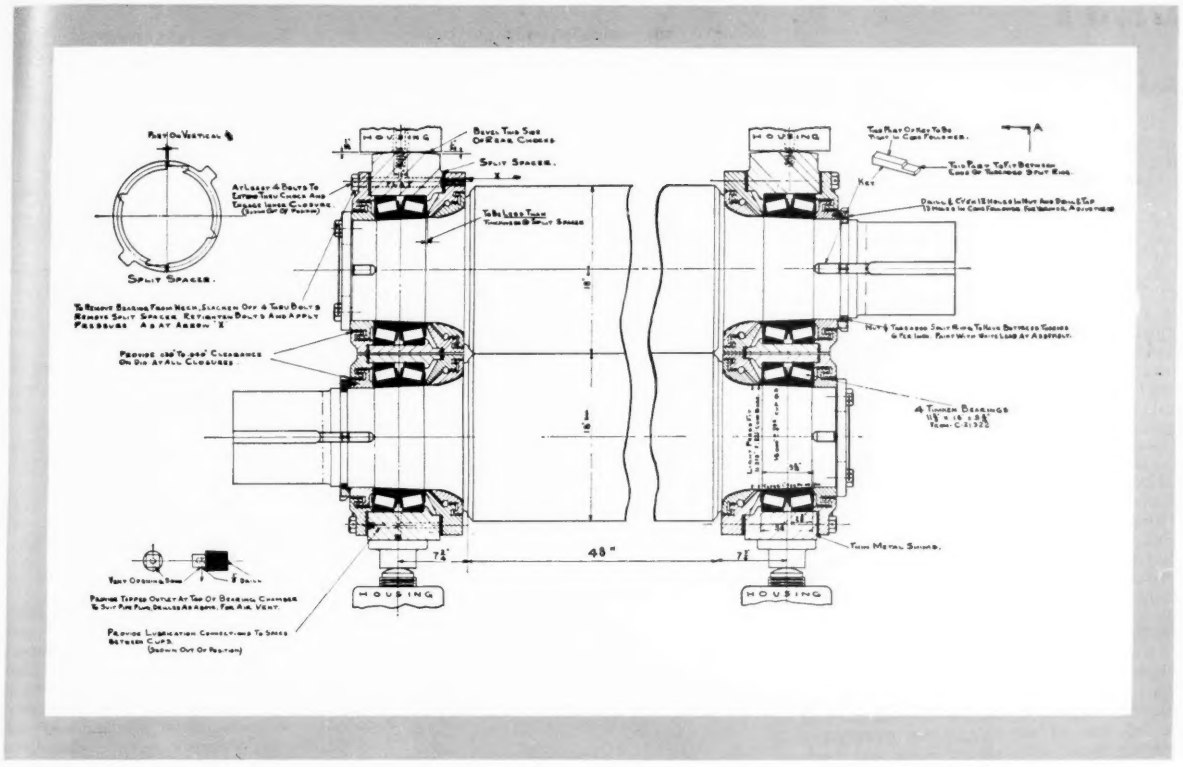
The president of the local URWA union at the Akron Goodrich plant, George R. Bass, in a statement made a few days after Mr. Keener's talk said that the union was making plans to tell the public that the Goodrich company is in a good financial position to meet the wage increase demands. Goodrich workers are 35% behind the increase in living costs since 1941 while company profits have gone up 800% since 1939, according to the local union president. He asserted that the union's demands will cost Goodrich "no more than $7,000,000 a year for the 13,000 workers in the Akron plants." He said the company could pay for the wage increases out of profits after taxes for the last three years of around $30,000,000, as compared with profits of $3,400,000 on an average between 1936 and 1939.

"Current Export Bulletin" No. 517, March 25, 1949, issued by the Office of International Trade, United States Department of Commerce, Washington 25, D. C., indicates that contact (include channel) and furnace carbon black have been added to the Positive List of Commodities requiring a validated license for exportation to all Group O and R destinations.

American Hard Rubber Co., 11 Mercer St., New York, N. Y., recently honored at a dinner at the University Club, New York, Albert V. Bristol, retiring senior vice president; Robert Harry, secretary and assistant treasurer, who joined the firm in 1900; Herman J. Schelhammer, assistant to the vice president in charge of manufacturing, whose service dates from 1918; and O. B. Carson, manager of sales promotion, associated with the company since 1919.

Mr. Bristol joined American Hard Rubber in 1915 after having been with G. & C. Merriam Co., Yale & Towne Mfg. Co., and American Brake Shoe Co. Mr. Bristol, who continues as a director of the rubber company, is active in the National Association of Cost Accountants, New York Chapter, and in the Controllers Institute of America, and is a trustee of the New Jersey Manufacturers Association.





Modern Roller Bearing Rubber Mills Do A Better Job At Lower Cost

It's a far cry from the old two-roll rubber mill to its modern Timken bearing equipped counterpart. For many years the application of Timken bearings was the only important improvement to be made in the two-roll mill. Various other refinements have since been developed, but nothing has contributed as much to efficient, economical mill operation as the application of Timken bearings. A typical example of a Timken bearing application in a modern 18″ x 18″ x 48″ rubber mill is shown in the drawing above.

When buying new rubber mills, masticators, refiners, Banbury mixers, extruders, calenders or any other kinds of equipment, make sure they are equipped with Timken tapered roller bearings. The Timken Roller Bearing Company, Canton 6, Ohio. Cable address "Timrosco".

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EAST

Safety Convention

The Nineteenth Annual Safety Convention and Exposition, sponsored by the Greater New York Safety Council and cooperating agencies, was held in the Hotel Statler, New York, N. Y., March 29 to April 1. The exposition comprised displays by 90 companies of all types of safety equipment, including new developments and standard items. As in previous shows, rubber and plastic items were very much in evidence, being shown in goggles, hoods, gloves and mittens, clothing, respirators and masks, aprons, and matting. Exhibitors of such items included American Optical Co., New York; Bausch & Lomb Optical Co., Rochester, N. Y.; Davis Emergency Equipment Co., Inc., Newark, N. J.; Goodyear Sundries & Mechanical Co., Inc., New York; Milburn Co., Detroit, Mich.; Miller Products, Inc., New York; Mine Safety Appliances Co., Pittsburgh, Pa.; Olympic Glove Co., New York; Pulmosan Safety Equipment Corp., Brooklyn, N. Y.; Safety Specialists, Inc., Newark; Scott Aviation Corp., Lancaster, N. Y.; Standard Safety Equipment Co., Chicago, Ill.; W. S. Wilson Corp., New York; and Willson Products, Inc., Reading, Pa.

Rubber acid handling equipment was shown by Wahlert Products Corp., Brooklyn; and A. Schrader's Son, Division of Scovill Mfg. Co., Inc., Brooklyn, showed a full line of air valves and controllers. Safety shoes with rubber soles and heels were displayed by Sundial Shoe Co., Manchester, N. H.; Iron Age Division, H. Childs & Co., Inc., Pittsburgh; Lehigh Safety Shoe Co., Inc., Allentown, Pa.; Safety Shoe Division, Thom McAn, New York; Safety First Shoe Co., Holliston, Mass.; and Titan Safety Shoe Co., Boston, Mass.

The convention, under the general chairmanship of Frederick F. Beik, Bankers Indemnity Insurance Co., consisted of an intensive four-day program of individual sessions covering all phases of industrial, commercial, marine, aviation, educational, and domestic safety. There were 48 separate sessions at which 104 papers were presented and eight panel discussions held. In addition, there were showings of safety films, presentations of awards to safety winners, luncheons, and the annual dinner on March 31.

Esso Club Joins RESA

Formal ceremonies marking the installation of the Esso Research Club as the first industrial affiliate of the Scientific Research Society of America were held on April 20 at the Esso Research Center, Linden, N. J. Founded in 1942, the Club is a social and scientific organization of technical employes of Standard Oil Co. (N. J.) and its affiliates. The Society was organized in 1947 by Sigma Xi, the honorary scientific society in the academic world, and parallels for industrial and governmental research workers the function of Sigma Xi. Donald B. Prentice, RESA director, presented the membership charter to Walter R. F. Guyer, Club president. Charles F. Kettering, director of General Motors Corp., was principal speaker on the program, which also included talks by George A. Stetson, RESA chairman; Frank W. Abrams, Standard Oil board chairman; and E. V. Murphree, president of Standard Oil Development Co.

Reopening Naples Plant

More efficient production and better political stability are helping Western Europe make a substantial degree of progress toward a "modest though not luxurious living standard," Hugh S. Ferguson, executive vice president, Dewey & Almy Chemical Co., Cambridge, Mass., said recently on arriving from a two-month trip to the Continent.

Mr. Ferguson announced that Dewey & Almy is reopening its Naples factory and is considering the possibility of establishing a plant in France. The Naples plant, started in 1927 to supply the needs of the Italian canning industry for container sealing compounds, was closed in 1940 because of the shortage of rubber. It subsequently sustained considerable damage during the fighting around Naples. After hostilities ceased, UNRRA made shipments of Dewey & Almy compounds from the United States. These supplies have kept the Italian canning industry going at a reduced rate geared to the availability of tinplate. The Naples plant will now resume operation. It will also produce products for the improvement of the quality of concrete used in construction.

"Western Europe is laying the groundwork for a better degree of political stability and becoming a field where manufacturers associated with American industry and using its 'know-how' can hope to operate profitably and pay for American backing," Mr. Ferguson said.

Witco Chemical Co., 295 Madison Ave., New York 17, N. Y., has developed a new method of packaging and shipping carbon black in bags by the use of 0.003-gage polyethylene bags tied with polyethylene cord. In preparing the rubber mix the bag and its contents can be thrown into the Banbury where, at a temperature of about 200° F., the polyethylene softens and is blended into the rubber. This method of shipment eliminates the problem of paper bag disposal as well as the dusting problem encountered when handling bagged carbon black. Another advantage of the polyethylene bags is that they are waterproof and protect the carbon black content from any moisture. The plastic bags stand up under shipping conditions in a very satisfactory manner; a recent shipment of channel black from Sunray, Tex., to Baltimore, Md., arrived in very good condition. The polyethylene bags are light, weighing approximately three ounces each, and may be used to package both 25- and 50-pound bags.

The Okonite Co., manufacturer of electrical wires and cable, Passaic, N. J., appointed three new vice presidents at the regular board meeting on April 19. These vice presidents are: I. W. Borda, with the company since 1924, who will continue as manager of the Pacific Coast District; W. R. Van Steenburgh, who joined Okonite in 1917 and will continue as manager of the north-east sales district; and Stephen A. Wilson, who has been with the company since 1936 and who will continue as secretary and general counsel.

Okonite has opened a new office in Dallas, Tex., at 1505 Tower Petroleum Bldg., with Otis W. Herring as manager. Mr. Herring, formerly in the Birmingham office, will be assisted by Sam K. Dick, sales engineer, who has been Okonite's Texas representative for the past 20 years. The Dallas office will be under the supervision of the Birmingham district.

Seiberling Reelects Officers

F. A. Seiberling was reelected chairman of the board of directors of Seiberling Rubber Co., Akron, O., for his twelfth consecutive term at an organization meeting April 18, and all other officers of the company were reelected, including J. P. Seiberling, president; J. L. Cochrun, executive vice president; H. P. Schrank, vice president in charge of production; L. M. Seiberling, vice president in charge of sales; R. J. Thomas, vice president and treasurer; C. E. Jones, vice president and comptroller; W. P. Seiberling, secretary; H. E. Thomas, assistant secretary-assistant treasurer; J. W. Dessecker, assistant secretary; W. H. Oburn, assistant treasurer.

The firm's directors were reelected at the annual stockholders' meeting on April 11. The board includes F. A., J. P., and L. M. Seiberling, Messrs. Cochrun, Schrank, and Thomas, A. C. Blinn, Warren H. Snow and Robert Guinther, Akron attorney and company counsel.

Shoe Manufacturers' Show

Price uncertainty because of a possible reduction on volume lines prompted cautious buying at the Shoe Manufacturers' Fall Opening held at the Hotel New Yorker, New York, N. Y., April 3 to 7. Occupying several floors of the hotel were exhibits of men's work, sport, loafer and dress shoes, women's leisure and dress shoes, slippers, and rain and beach footwear, most of which contained some rubber application. Crepe rubber soles of all colors were again being pushed strongly by manufacturers.

Bata Shoe Co., Inc., featured tennis shoes, rubber footwear, and shoes with waterproof bottoms; Converse Rubber Co. showed rubber footwear; while Cambridge Rubber Co. displayed play shoes; and So-lo Works, Inc., presented "Totes" overshoes and introduced new "Play-Totes." Norwalk Tire & Rubber Co., American Rubber Co., and Winchester Rubber & Plastics Co. exhibited various types of soling and heels. In addition were showings by Endicott-Johnson Corp., Tyer Rubber Co., and Frankel Plastics.

40 Years for Polson

The Polson Rubber Co., Garrettsville, O., is celebrating its fortieth anniversary this year. The company was founded in Kansas City, Mo., in 1909 by Harry B. Polson, now chairman of the board, and his brother, Charles A. Polson, who retired from active participation in the management several years ago and who died three years ago.

From tire reliners, its original product, the firm progressed to various types of boots and patches, but when the repair business went into a gradual decline, Polson went into the production of inner tubes, selling at home and abroad.

In 1917, in addition to the plant in Kansas City, a plant was established in Cleveland, O. After World War I these plants were consolidated at Cleveland, and in 1923 the company moved to Garrettsville.

W. J. Frisby is president and general manager of the company; J. W. McConnell, secretary; and F. H. Blum, treasurer. All production is under the supervision of Carl E. McNeill, factory manager.

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can be added at the
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First shipment of natural rubber containing PEPTON 22 from Teluk Merbau Plantations is unloaded at a New York dock. The PEPTON 22 was incorporated in the latex prior to coagulation.

PEPTON 22 Plasticizer, a free-flowing powder, can now be incorporated into latex at the plantation...or it can be added to natural rubber or GR-S during the milling process. In either case, it acts as an efficient peptizer or catalytic plasticizer.

PEPTON 22 cuts breakdown time at least 50% and reduces power consumption. It improves processing qualities and has no effect on the physical or aging characteristics of the rubber. ®

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General Tire Reelects Board

Shareholders of The General Tire & Rubber Co., Akron, O., at their annual meeting April 5, reelected all directors and approved the addition of Treasurer John O'Neil, to the board. The election of Mr. O'Neil fills the vacancy created March 10 when Dan A. Kimball resigned his connections with the company to accept appointment by President Truman as Assistant Secretary to the Navy for Air.

Reelected directors follow: chairman, William O'Neil, W. E. Fouse, C. J. Jahant, L. A. McQueen, S. S. Poor, C. F. O'Neil, Robert Iredell, Howard Jordan, Hayes R. Jenkins, and Thomas F. O'Neil.

Also approved by the shareholders was an amendment to the code of regulations increasing board membership to 15. It is not the present intention to fill the newly created directorships.

John O'Neil was appointed General's treasurer April 6, 1948. He was graduated from Holy Cross College in 1938 with an A. B. degree. He also is a graduate of the Harvard Law School, completing this studying in 1941, just prior to entering the service as a lieutenant in the Coast Guard.

William O'Neil has been named acting chairman of the board of National Council for Community Improvement, 1760 K St., N. W., Washington 6, D. C., which is engaged in encouraging individuals and organizations in American communities to readopt the old New England Town Meeting type of approach to local problems and to undertake local improvements on a self-reliant basis.

Thomas F. O'Neil was recently elected board vice chairman of the Mutual Broadcasting System. He is also vice president and member of the board of Yankee Network.

A veteran of 17 years in the rubber manufacturing business, Harry A. Carragher has been appointed truck tire sales manager of General's Minneapolis-St. Paul branch, covering Minnesota, North and South Dakota, western Wisconsin, northern Iowa, and northeastern Nebraska. During World War II, Mr. Carragher served as administrative assistant of the Rubber Conservation Division of the Rubber Development Corp. and spent three years in 21 Latin American countries expediting production of foreign plants of U. S. companies.

Diamond Alkali Co., 300 Union Commerce Bldg., Cleveland 14, O., has appointed Chester D. Jones, Jr., as purchasing agent. In assuming his new post, Mr. Jones returns to Diamond's general headquarters at Cleveland from Houston, Tex., where he has served "on leave" since 1946 as plant purchasing agent during the construction and initial production period of the company's recently completed $14,500,000 electrolytic chlorine-caustic soda plant. Mr. Jones first joined Diamond's purchasing department as a buyer in 1938.

Three other departmental promotions were announced simultaneously with this appointment. W. C. Logan, with the department since 1925, moves up as assistant purchasing agent. W. C. Mahan, also a 24-year Diamond man, who has been in purchasing since 1937, similarly advances to assistant purchasing agent. P. P. Eppinger, who first became associated with Diamond in the purchasing department of its Houston plant two years ago, succeeds Mr. Jones as plant purchasing agent there.

Erecting New Buildings

United States Rubber Co., Rockefeller Center, New York 20, N. Y., will build a new $250,000 laboratory for textile research and development at Winnsboro, S. C., it was announced by H. Gordon Smith, vice president and general manager of the company's textile division. The new building will adjoin the company's textile mill and permit consolidation of research and development work previously carried on in Winnsboro, Hogansville, Ga., and elsewhere, in addition to providing for substantial expansion of these activities. S. H. Sherman, manager of the division's development department, will be in direct charge of the laboratory under the general supervision of R. C. Harrington, technical director of the textile division. The new laboratory will provide pilot-plant operations serving all the mills of the division, although additional facilities will also be available at each mill. Construction of the new laboratory will begin as soon as building plans are completed, and the new facilities are expected to be in operation in about eight months.

Construction of a new warehouse in Chicago, Ill., for U. S. Rubber is well under way and is expected to be completed by May 15. Situated at S. Pulaski Rd. and 42nd St. in the central manufacturing district, the new warehouse will be a one-story building with 175,000 square feet of floor space. The project will cover more than four acres of land and will supersede present warehousing facilities at 440 W. Washington St.

As one of the principal stocking points in the company's distributing system, the warehouse will handle distribution of merchandise for the Midwest area. Products to be handled include tires, mechanical goods such as belting, hose, wire and cable, footwear and clothing, textile products, agricultural chemicals, druggists sundries, Koylon mattresses, and numerous other items manufactured by U. S. Rubber.

Growth of the company's business in the Chicago area and the continued expansion of industry in the Midwest necessitated larger warehousing facilities. At present U. S. Rubber has seven plants in the Midwest area: Detroit (tires); Indianapolis (inner tubes); Eau Claire (tires); Mishawaka (footwear); Fort Wayne (mechanical goods); Chicago (plastics); and Washington, Ind., (clothing).

The company's Chicago branch office personnel and sales force comprising some 300 persons are headquartered in the Merchandise Mart Bldg.

U. S. Rubber held its annual shareholders' meeting in Passaic, N. J., on April 19, when it was voted to increase the number of directors from 18 to 19 in order to permit the reelection of Lucius D. Tompkins, who resigned December 31, 1948, so that Vice President Arthur Surkamp could be elected a director on January 1, 1949. At the April 19 meeting all directors were reelected.

Sharples Chemicals, Inc., 123 S. Broad St., Philadelphia 9, Pa., has announced that E. P. Chaput, technical assistant to the vice president in charge of sales, has left to become assistant to the executive vice president in charge of Sharples Oil Corp., Denver, Colo. L. E. Parks has been transferred from Los Angeles, Calif., to replace Dr. Chaput; while T. C. Dabovich, formerly of the firm's Chicago office, is now technical representative for the West Coast, with headquarters in Los Angeles.

Goodyear Elections

P. W. Litchfield was reelected chairman of the board and chief executive officer of The Goodyear Tire & Rubber Co., Akron, O., at a board meeting which followed the fiftieth annual meeting of stockholders on March 28. Mr. Litchfield has been chief executive officer of Goodyear since 1926 and has served continuously as a director of the company since 1906.

Other executive officers also were reelected, including E. J. Thomas, president; R. S. Wilson, P. E. H. Leroy, R. DeYoung, J. M. Linforth, R. P. Dinsmore, F. W. Climer, vice presidents; Z. C. Oseland, treasurer; W. D. Shilts, secretary; C. H. Brook, comptroller; H. L. Hyde, general counsel and assistant secretary; H. W. Hillman and J. F. Bennett, assistant treasurers; W. M. Mettler, assistant secretary; H. D. Hoskin, H. L. Riddle, and J. E. Caldwell, assistant comptrollers.

All directors were reelected at the annual meeting, including A. G. Cameron, R. S. Damon, T. M. Girdler, E. B. Greene, J. C. Hunsaker, J. P. McWilliams, R. G. Payne, B. A. Polsky, G. A. Sloan, C. F. Stone, L. B. Williams, and Messrs. DeYoung, Hyde, Leroy, Litchfield, Thomas, and Wilson.

International Latex Corp., Dover, Del., has elected Vice President W. O. Heinze to the presidency, succeeding A. N. Spanel, founder of the firm, who becomes chairman of the board. Mr. Heinze came to the company as general manager in September, 1943, and was put in charge of all plant manufacturing operations. At that time the company was engaged entirely in war work, and with the cessation of hostilities Mr. Heinze played a leading role in converting the company back to civilian business. According to Mr. Spanel, the company in Dover now employs five times the number of workers it had before the war, in the manufacture of civilian goods.

At the same time the company also announced that Frederick W. Andrews, in charge of research and development for the past three years, has been promoted to vice president; while Irving Obrow has been made assistant treasurer.

E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., has made a second reduction in the prices of all lead-containing inorganic pigment colors, applying to shipments made on or after April 8. Prices of chrome yellows and chrome oranges were reduced 1¢ a pound; while molybdate orange and chrome green prices were lowered by ½¢ a pound. A previous reduction was made by du Pont on March 17 when the same pigments were lowered by similar amounts. Both reductions were made possible by the recent declines in the price of lead.

The Mansfield Tire & Rubber Co., Mansfield, O., has made three major appointments in its sales department, according to General Sales Manager E. E. Stevens. Carl B. Gibson, division sales manager in the central states, has been made assistant general sales manager; while Charles F. Orr, Jr., district sales manager in the southeastern states, has been advanced to sales manager of special accounts. W. J. Jarman, district sales manager in the north central states, assumes Mr. Gibson's former post, with headquarters in Minneapolis, Minn.

You Will Want THIS BOOK

Mechanical Goods PRESSES
A press for seamless belts, of the two-opening type. This design eliminates cantilever beams and provides rigidity through the use of very heavy rolled steel sections. This particular machine has platens 40" x 37" and is of 380-ton capacity. The platen rollers and the stretcher mechanism are not shown in the photograph.
Another type of press for seamless belts, a 1232-ton gooseneck belt press with platens 50" x 92". This press is complete with clamps and stretcher; the maximum clamping force is 300 tons and the maximum stretcher force 130 tons. The platen drilling is sectionalized so that any parts of the platen can be heated or cooled as desired. This press was designed and machined so that when under load the entire platen areas remain parallel within very limited tolerances.
A 4200-ton two-opening press for flat stock, with platens 52" wide and 18' long. Presses of this type are built in sizes up to 76" wide x 36' long. The press shown has simplex hydraulic breaker cylinders. Larger machines are generally built with bell crank equalizer linkage to hold the platens parallel.
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Calco Chemical Division, American Cyanamid Co., Bound Brook, N. J., through S. C. Moody, vice president and general manager, has announced the consolidation of research, process development, and dyes technical service into a single department. This new department will be known as the research and development department, headed by K. H. Klipstein, Calco assistant general manager. H. Z. Lecher has been named director of research in charge of the chemical research department. Mario Scalera has been appointed assistant director of research, and R. P. Parker, assistant director of research, will be in charge of the pharmaceutical research section. R. H. Kienle and A. L. Peiker were appointed director and associate director, respectively, of application research. M. L. Crossley, under whose direction Calco's research department has developed into one of the nation's most important industrial research centers, is retiring in August, 1949, and will act as special consultant to Mr. Moody and to the heads of the research and development department.

Calco in the April issue of its informal journal, *Dyelines and Bylines*, noted that soft rubber mats measuring eight feet square are now being used under some apple trees to prevent bruising of the fruit which falls to the ground during picking time. The sponge-like mats are soft enough to give under impact and cushion the shock of falling, thus preserving the appearance and quality of the apples.

The B. F. Goodrich Chemical Co., 324 Rose Bldg., Cleveland 15, O., has appointed T. C. Culver representative for Hycar and rubber chemicals, covering western New York, Pennsylvania, Ohio, eastern Michigan, and a number of southern states. He has been with the organization since 1940 and during the war served as chief chemist at the company's Louisville GR-S plant operated for the government. He joined the sales service laboratory of the B. F. Goodrich Chemical Co. in 1947, where he was engaged in sales development work.

Robert L. Moore, formerly vice president in charge of research and development, Robbins Tire & Rubber Co., Tuscumbia, Ala., recently accepted the position of director of research and product development, United States Asbestos Division, Raybestos-Manhattan, Inc., at Manheim, Pa.

William H. Lycan has been made director of research for Johnson & Johnson, New Brunswick, N. J., succeeding David F. Smith, resigned. Dr. Lycan for the past 11 years had been executive director of research for the paint division of Pittsburgh Plate Glass Co.

Rubber Corp. of America, 274 Ten Eyck St., Brooklyn 6, New York, has been appointed exclusive sales agent by N. V. Rubber Cultuur Maatschappij "Amsterdam," Holland, for its natural rubber latex and latex concentrates. 61-63% RCMA centrifuged latex is now available in bulk and in drums. Users of latex will remember the RCMA brand from prewar times. RCMA latex and latex concentrates are produced on the rubber estates in Sumatra, Netherlands India, which are owned and operated by N. V. Rubber Cultuur Maatschappij.

WEST

Leland I. Doan

Dow Shifts Executives

Several changes among executives of The Dow Chemical Co., Midland, Mich., were made April 5 by the directorate, following the death of Willard H. Dow.

Earl W. Bennett, company treasurer since 1930, was elected chairman of the board, and Leland I. Doan was elected president. He had been a vice president since 1938 and secretary since 1941. Mark E. Putnam, a vice president since 1942, was named general manager. Dr. Dow had formerly held all three of the positions thus filled, but in recent years had abandoned the titles of chairman of the board and general manager.

Two new vice presidents also were named: A. P. Beutel, general manager of Dow's Texas division, and Russell L. Curtis, general manager of the Great Western division. Carl A. Gerstacker was elected treasurer, and Calvin A. Campbell, secretary.

Mr. Bennett also maintains the vice presidential post to which he was named in 1931 and also remains chairman of the company's finance committee. He began his career with Dow in 1900 as bookkeeper for the then-infant concern, two years later became auditor, in 1905 assistant secretary and assistant treasurer, and a director since 1927.

Mr. Doan, a brother-in-law of the late Dr. Dow, in 1918 entered the firm's industrial chemicals division. He was made assistant sales manager in 1922, general sales manager in 1929, a director in 1935, and director of sales in 1945.

Dr. Putnam joined the company in 1915 as a research chemist and rose through various supervisory levels to production manager. He became a director in 1941 and a vice president the following year. He has also been president of Cliff's Dow Chemical Co. since 1939.

Dr. Beutel, who started with the company as an engineering draftsman in 1914, won many promotions to supervisory roles and then was made assistant to the president and assistant general manager. When Dow began construction of its Texas division in 1940, he moved there to supervise its construction and become its general manager. Dr. Beutel has been assistant secretary since 1941, a member of the board since June 1, 1948, and president of Dowell, Inc., since 1939.

Mr. Curtis has been with the company since 1922, when he started in the insecticide sales division. He was made assistant sales manager in 1931 and, when Dow absorbed the Great Western Electrochemical Co. in 1938, Mr. Curtis moved to San Francisco as executive manager of the West Coast project. A few months later he was named general manager of the Great Western division and in 1941, an assistant secretary. He was appointed to the directorate in 1948.

Mr. Gerstacker started in the auditing and accounting department of Dowell, Inc., a Dow subsidiary, in 1938. His career there was interrupted by service in the army from 1940 to 1946. Returning to the parent company, he was made assistant director of purchases and was appointed assistant treasurer in March, 1949. A director since June 1, 1948, he has also served on the finance committee.

Mr. Campbell, Dow's general counsel, entered Dow as head of the legal department in 1935 and became a director in 1948.

Giffels & Vallet, Inc., and **L. Rossetti,** 1000 Marquette Bldg., Detroit 26, Mich., recently announced that a representative, Edward X. Tuttle, director of foreign operations and of the company's eastern division, is flying to the Orient and Europe to survey problems of industrialization and reconstruction. Mr. Tuttle will visit Tokyo, Taiwan, Calcutta, Cairo, Israel, Istanbul, Rome, Torino, Paris, and London. Countries which are building or rebuilding their economies need American technological service, skills, and experience, Mr. Tuttle said. In order to be of real usefulness their problems, which differ in every country, must be looked into on the spot, and it is for this reason that the company decided to obtain first-hand information as a basis for planning and service. The trip will be made entirely by air, with Mr. Tuttle leaving this country in April and returning in June.

J. C. Ballagh has resigned as vice president and general manager of Patterson-Ballagh, Division of Byron Jackson Co., 1900 E. 65th St., Los Angeles 1, Calif. Mr. Ballagh, who was with Patterson-Ballagh for 22 years, will devote his interests to the firm of Extruders, Inc.

Aerojet Engineering Corp., Azusa, Calif., has appointed Theodore von Karman chairman of its newly created technical advisory board, which also includes Fritz Zwicky, rocket expert and astrophysicist; Clark Millikan, director of the Guggenheim Aeronautical Laboratory, California Institute of Technology, and Hsue-Shen Tsien, recently appointed Robert H. Goddard, professor of the Daniel & Florence Guggenheim Jet Propulsion Center at C.I.T. Aerojet's technical advisory board will be responsible for the overall technical planning of the company, with particular emphasis on the direction of the research department. This arrangement will free Dr. Zwicky, formerly director of research, for broader consultation assignments on technical problems of the company.

Howard Keefer is now chief chemist at Reeves Rubber, Inc., San Clemente, Calif.

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SERVING INDUSTRY...WHICH SERVES MANKIND

Scrap Rubber Institute Elects

New officers of the Scrap Rubber Institute were elected at a meeting on March 22 as part of the thirty-sixth annual convention of the National Association of Waste Material Dealers, Inc., held at the Stevens Hotel, Chicago, Ill., on March 21 to 23. The following slate of officers, presented by the nominating committee, was unanimously elected: president, Henry M. Rose, H. Muehlstein & Co., Inc.; vice president, Roger Ottignon, Nat E. Berzen, Inc.; and secretary-treasurer, George W. Reid, NAWMD. Members of the executive committee, in addition to the new officers, include Louis Fishman, Louis Fishman & Co.; Ben Gordon, A. Schulman, Inc.; Abe Lowenstein, A. Lowenstein Co.; and the retiring president, J. J. Costello, Tanney-Costello Co.

Moving Plant to Texas

The new home of Wrightex and Wrightflor rubber tile, a $2,000,000 plant, is nearing completion in Houston, Tex., and will begin production within a few weeks.

The Wright Mfg. Co., manufacturer of rubber tile, molded rubber and plastics items, is moving to Houston from Milwaukee and Racine, Wis.

While President Thomas F. Millane is expected shortly, other key personnel already have moved to Houston. They are: A. E. Wright, vice president in charge of production; R. Frank Wilson, vice president; Jack Millane, secretary-treasurer; B. R. Scheff, general sales manager; M. E. Borngesser, sales manager of the flooring division; Carl Eckenrod, superintendent of the plastics and molded rubber division; R. I. McDonald, chief accountant; and Al Morani, assistant accountant.

While the plant is under construction, orders are being processed through temporary offices at 300 Seventh St., Bellaire, Tex., and filled through the Racine plant.

The company will double production of rubber tile in the new plant and has an eye toward export through the port of Houston. It will employ 300 persons. New but proved mass production methods will be used in the new plant, which will be operating within a few miles of a large source of synthetic rubber and a wealth of other raw materials.

Wright began production of rubber tile flooring 27 years ago. Wrightex is a soft tile for use in the home and hospitals—wherever quiet is desired, and traffic is not excessively heavy. In schools and public buildings the harder tile, Wrightflor, is preferable because of durability and low maintenance cost.

The company is adding three new colors to its Wrightex line, colors which have been popular several years in Wrightflor. These are marbleized cream with green, cream with red, and cream with blue. This addition will give the company 20 color combinations of Wrightex and 17 color combinations of Wrightflor.

President Millane has also announced that Wright-On-Top, the compression base manufactured in black only, will now be produced in marbleized patterns in gold-brown, green-cream, blue-cream, light gray-black-cream, light brown-black-red-cream. The base goes around the wall and has a 3/4-inch feather edge extending out over the floor which, through compression, makes an air and water tight seal.

The company is also a producer of industrial plastics as well as proprietary items and such household articles as bowls, trays, strainers, funnels, and toilet seats.

Aerial View of New Plant of The Goodyear Tire & Rubber Co. of Canada, Ltd., Quebec

Principal molded rubber items are mallets, mats, and football cleats.

Expanding its sales network in conjunction with doubling of production, Mr. Millane has named 18 direct factory representatives in key cities of the United States and a large number of distributers, with others to be designated in the next few months.

Yale Rubber Mfg. Co., according to President E. H. Henderson, is now in full-scale operation at its new plant at Sandusky, Mich., to which it has transferred its general offices from Yale, Mich. With the construction of new warehouse and mixing buildings Yale Rubber now has more than 60,000 square feet of floor space devoted to the manufacture of molded rubber and extruded and sheet goods products. Considerable new equipment also has been installed at the new plant, which was acquired about a year ago. These new facilities more than double the company's previous molded goods capacity. Yale Rubber which was organized four years ago, also maintains a sales office and warehouse at 1433 Holden Ave., Detroit, Mich.

The Third Annual Chicagoland Management Conference, sponsored by the National Association of Foremen, was held April 2 at the Congress Hotel, Chicago, Ill. Arthur C. Horrocks, public relations counsel, Goodyear Tire & Rubber Co., spoke on "The Half Way Mark"; and James G. Barbour, general manager, Sirvene division, Chicago Rawhide Mfg. Co., was chairman of the program committee for the Conference and also chairman of a panel discussion of "International Affairs—How Do They Affect You as a Member of Management."

Pacific Hard Rubber Co., 555 S. Flower St., Los Angeles 13, Calif., has transferred Fred W. Reiter to the research department as research chemist. His former position, chief control chemist, goes to Melvin A. MacDonald.

Ohio-Apex Inc., Nitro, W. Va., has appointed the following as its distributers in their respective areas: Amsco Solvents & Chemicals Co., Cincinnati, O.; Ohio Solvents & Chemicals Co., Cleveland, O.; Hoosier Solvents & Chemicals Co., Indianapolis, Ind.; Missouri Solvents & Chemicals Co., St. Louis, Mo.; Southern Solvents & Chemicals Co., New Orleans, La.; and Texas Solvents & Chemicals Co., Houston, Tex. Each of these companies will carry stocks of Ohio-Apex plasticizers in their warehouses.

CANADA

Opens New Factory

Goodyear Tire & Rubber Co. of Canada, Ltd., New Toronto, Ont., on March 24 held formal opening ceremonies of its new molded rubber goods factory in the City of Quebec. This plant, which has an area of 172,000 square feet and at present employs about 200 workers, is the newest addition to Goodyear's six modern Canadian factories. One of its outstanding features is that manufacturing operations are carried out on one large floor.

At the opening celebration, after the blessing of the building and machinery by the local parish priest, Factory Manager A. Hurst welcomed some 500 guests, including: J. R. Deschamps, manager of the Eastern Quebec division of Goodyear's sales department, who acted as master of ceremonies; Paul W. Litchfield, chairman of the board, Goodyear Tire & Rubber Co., Akron, O., who was one of the speakers; E. J. Thomas, president, Goodyear, Akron; A. G. Partridge, president of Goodyear Canada; R. C. Berkinshaw, vice president and general manager of Goodyear Canada, who also made an address; A. W. Denny and P. A. Thomson, vice president in charge of production and a director, repectively, of Goodyear Canada; A. G. Cameron, president, Goodyear Export Co.; and G. K. Hinshaw, manager of Goodyear's foreign plants' production.

Polymer Corp. Salaries

In a Canadian House of Commons return, the Government informed J. W. Murphy, P.C., that J. R. Nicholson, executive vice president of Polymer Corp., Ltd., Sarnia, Ont., is paid $25,000 a year. Salaries of other senior officers of Polymer were given as $15,000 for E. J. Brunning, president and board chairman; $15,000 for E. R. Rowzee, manager; $10,500 for Stanley Wilk, comptroller; and $5,300 for W. J. Dyke, secretary-treasurer. The return said that the company directors, except for Messrs. Brunning and Nicholson, serve without pay, but receive traveling and living expenses for business trips.

Fargo Rubber Corp., 137 E. 58th St., Los Angeles, Calif., has announced the resignation of President and General Manager Frank M. Fargo, who has sold his interest in the concern to Vice President and Sales Manager H. M. Samson, who has assumed the presidency.

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APPLICATION

United States

2,462,887. **Coaxial Cable.** F. A. Muller, Newark, N. J., assignor to Federal Telephone & Radio Corp., New York, N. Y.

2,462,977. **In the Jointing of a Polyethylene Insulated Cable, the Application of a Coating, Fusible with Polyethylene, Containing Polyethylene and a Polymerized Olefin.** D. W. Kitchin, Wellesley Hills, Mass., and F. R. Dyke, Dartmouth, N. S., Canada, assignors to Western Union Telegraph Co., New York, N. Y.

2,463,002. **Nose and Throat Atomizer.** M. H. Smith, Athens, Tenn.

2,463,059. **Resilient Mounting for Motors, Etc.** C. Saurer, Detroit, Mich., assignor to Ohio Rubber Co., Willoughby, O.

2,463,121. **In a Vehicle Wheel Assembly Including Supporting Body Means, Endless Cushioning Means Surrounding the Body Means.** J. P. Sapp, Kent, O., assignor to B. F. Goodrich Co., New York, N. Y.

2,463,327. **Portable Water Disinfecting Unit, Including a Container Entirely of Water-Insoluble Plastic Material.** F. D. Snell and R. L. Shapiro, assignors to Foster D. Snell, Inc., all of New York, N. Y.

2,463,341. **In a Water Motor-Pump Unit, a Pedestal-Like Base in Which Is Mounted a Stator Having a Rubber-Lined Female Threaded Chamber.** J. B. Wade, Arcadia, assignor to Food Machinery & Chemical Corp., San Jose, both in Calif.

2,463,361. **In an Undercarriage of an Aircraft, Foldable Pneumatic Cell Means Mounted on Retractable Brackets.** H. L. Bowers, Greiner Road, assignor to Bell Aircraft Corp., Wheatfield, both in N. Y.

2,463,448. **In a Paper Jogger Including a Base and a Table, Spaced Rubber Members, Resiliently Supporting the Table on the Base for Vibration.** C. S. Weyandt, Homer City, Pa.

2,463,522. **Means for Supporting a Vehicle Including a Vehicle Supporting Wheel on Which Is Mounted a Resilient, Hollow, Liquid-Containing Tire from the Interior of Which a Conduit Leads to a Liquid Containing Tank.** T. O. Davidson, assignor to Bucyrus-Erie Co., both of South Milwaukee, Wis.

2,463,551. **Artificial Tooth Containing a Series of Cells Filled with Polymerized Methyl Methacrylate, Styrene, Vinyl Acetate, or Vinyl Chloride.** S. and M. S. Myerson, both of Brookline, Mass.

2,463,641. **Life Belt with Gasproof Walls, Adapted to be Adjusted to a Garment at Waist Height.** J. J. Podell, New York, N. Y.

2,463,730. **Suspensory and Health Belt.** M. M. Weiss, New York, N. Y.

2,464,102. **Cushion of Rubber or the Like in a Resilient Car Wheel.** A. R. Schulze, Johnstown, Pa., assignor to Carnegie-Illinois Steel Corp., a corporation of N. J.

2,464,136. **In a Bellows Seal, Elastic Rings Encircling Lips in Contact with Packing and Carrier Rings and Seated in Counterbores in the Packing and Carrier Rings.** J. B. Jenkins, Rockford, Ill., assignor to Twin Disc Clutch Co., Racine, Wis.

2,464,251. **Rubber Heel.** H. H. Moody, San Francisco, Calif.

2,464,308. **In a Nut Huller Including a Hopper and Circular Cutting Blades, a Cushion of Sponge Rubber Faced with a Sheet of Ordinary Rubber Lining the Side of a Passage Leading from the Hopper Past the Side of the Blade Assembly.** F. C. Gullo, Cupertino, Calif.

2,464,391. **Artificial Limb Having Cosmetic Covering of Layers of Lightweight Plastic Foam.** G. C. Havens, San Diego, Calif., assignor to Consolidated Vultee Corp., a corporation of Del.

2,464,827. **Airplane Fuel Tank, Including a Bladder Cell of Light, Fuel-Resistant Sheet Material. Partitioned to Define a Sub-cell.** H. Noyes, Dayton, O.

2,464,926. **Laminated Structure Consisting of Sheets of Hard Acrylic Resin Interleafed with Layers of Plasticized Polyvinyl Acetal Resin.** H. T. Neher, Bristol, and La V. N. Bauer, Philadelphia, assignors to Rohm & Haas Co., Philadelphia, both in Pa.

2,464,988. **Single Convolution Rubber Sealing Element.** F. E. Payne, Glencoe, Ill.

2,465,069. **For a Submarine Cable Having a Polythene Insulated Central Conductor, a Repeater Device Including a Housing of Corrugated Metallic Tubing Having an Insulation Sheath of Polythene Molded to the Cable Insulation.** J. N. Dean, Moretons, and E. W. Smith, Beechcroft, assignors to Telegraph Construction & Maintenance Co., Ltd., London, all in England.

2,465,120. **Shoulder Pad, Including a Lightweight Porous Rubber Body Member.** R. E. Riley, Los Angeles, Calif.

2,465,225. **Polishing Wheel, Including a Pad of Resilient Rubber-Like Material for Supporting and Cushioning a Strip of Abrasive Sheet Material.** U. C. Haren, Akron, O., assignor to B. F. Goodrich Co., New York, N. Y.

2,465,268. **Inflatable Pneumatic Bed.** W. C. Rogers, Scarsdale, and A. V. Anderson, Beacon, assignors to New York Rubber Corp., New York, all in N. Y.

2,465,284. **Magnetic Sheet Material Having an Insulating Film of Thermoset Melamine-Formaldehyde in Which Finely Divided Solids Are Distributed.** P. L. Schmidt, Perrysville, and J. A. Campbell, Pittsburgh, assignors to Westinghouse Electric Corp., East Pittsburgh, Pa.

2,465,374. **Waterproof Fabric Seam Including a Tape of Polyvinyl Resin.** H. H. Haman and W. E. Schmidt, assignors to Warren Featherbone Co., all of Three Oaks, Mich.

2,465,493. **Battery Separator Including a Microporous Sheet of Organic Plastic Composition.** S. I. Strickhouser, Edgewood, and E. C. Uhlig, Greenwood, both in R. I., assignors to United States Rubber Co., New York, N. Y.

2,465,499. **Mechanical Seal for Relatively Rotatable Elements, Including a Diaphragm of Flexible Resilient Deformable Material.** C. F. Voytech, assignor to Crane Packing Co., both of Chicago, Ill.

2,465,566. **Hollow Dress Form Composed Solely of Compressible, Inherently Resilient Material.** R. W. Akers, Freeport, Tex.

2,465,612. **In a Shoe Press, an Inflatable Sole Pressing Pad.** E. F. Small, Newton, assignor to Compo Shoe Machinery Corp., Boston, both in Mass.

2,465,640. **Spring Wheel with an Outer Circular Tread Member of Rubber.** B. Ferrar, Chicago, Ill.

2,465,719. **Device to Reduce Leakage of Energy through a Space between Ends of Waveguides in a Super-High Frequency Apparatus, Including a Compressible Conductive Rubber Member Continuously Occupying This Space.** G. L. Fernsler, Lawrenceville, N. J., assignor to Radio Corp. of America, a corporation of Del.

2,465,725. **Flat Foot-Exercising Pad, Including a Flexible Resilient Tread Layer and Resilient Spherical Surfaces Arranged in Rows against the Undersurface of the Layer.** M. H. Herzmark, Washington, D. C.

2,465,732. **In a Discharge Tube Including an Electrode in an Envelope, Thermoplastic Insulating Material Bonding the Electrode to a Supporting Member.** H. Lems, Eindhoven, Netherlands, assignor, by mesne assignments, to Hartford National Bank & Trust Co., Hartford, Conn.

2,465,754. **Truss Supporter with Elastic Inserts.** M. Rubinger, New York, N. Y.

2,465,821. **In a Geiger-Muller Counter, a Tubular Cathode Having a Window Covered by a Thin Sheet of Polyvinylformal.** R. Smoluchowski, Schenectady, N. Y., assignor to General Electric Co., a corporation of N. Y.

2,465,908. **Accumulator Bag of Flexible and Elastic Material.** J. Mercier, New York, N. Y.

2,465,911. **Waterproof Shoe Protector, the Upper Leg Portion of Which Is Divided into Severable Sections.** P. K. Morgan, Ridgeley, W. Va.

2,465,919. **Pantie Girdle Having a Rear Section of Vertically Stretchable Plastic Material, the Remaining Portion Being of Horizontally Stretchable Elastic Material.** B. Murdock, Brooklyn, N. Y.

2,465,973. **High Elevation Mask.** A. H. Bulbulian, Rochester, Minn.

Dominion of Canada

412,654. **Vehicle Tire Having a Circular Tread and Flat Tread Sections, so Constructed That the Circular Tread Takes the Load on Hard Surfaces, and the Flat Tread Sections Take the Load on Soft Ground, Snow, Mud, Etc.** C. R. MacCallum, Glasgow, Scotland.

454,702. **In a Friction Coupling, a Drum within Which Is an Independently Rotatable Boss to Which Are Pivoted Arms to the Ends of Which Are Pivoted Links, to Which in Turn Are Pivoted Shoes; All Pivots Are of Rubber or Like Resilient Material.** C. W. Chapman, Horley, Surrey, England.

454,847. **Gear-Type Liquid Pump, Including Toothed Intermeshing Impellers of Resilient Plastic Material.** R. W. Fernstrum, assignor to Gray Marine Motor Co., both of Detroit, Mich., U.S.A.

454,921. **Fluid-Tight Seal for Connecting a Pipe and a Union Member, Including a Cylindrical Sleeve of Elastic Material.** J. Lubbock, Lord Avebury, London, England.

454,955. **In Apparatus for Freezing Ice Cubes, Ice Cube Molds Including a Hollow Rubber Honeycombed Cylinder.** A. D. Smith, assignor to Berium Steel Corp., both of Canton, O., U.S.A.

454,998. **High-Frequency Cable Having a Stranded Core with Conductors Coated and Interstices Filled with Soft, Low Molecular Weight Polystyrene; While the Core Is Surrounded by Relatively High Molecular Weight Polystyrene.** A. J Warner, South Orange, N. J., assignor to Federal Telephone & Radio Corp., New York, N. Y., both in the U.S.A.

455,009. **Pneumatic Tire for Motor Vehicles Operating in Soft Muddy Soil.** W. S. Coben, assignor to Firestone Tire & Rubber Co., both of Akron, O., U.S.A.

455,088. **Assembly Including an Inflatable Container and an Envelope Having a Sealable Watertight Closure** H. J. Sturtevant, assignor to Wingfoot Corp., both of Akron, O., U.S.A.

455,151-152. **Ice Eliminating System for Aircraft, Including Inflatable Rubber Boots, a Pump to Provide Superatmospheric Pressure, and Means for Removing Oil from the Oil-laden Air from the Pump.** D. M. Lawrence, Wood Ridge, N. J., assignor to Bendix Aviation Corp., South Bend, Ind., both in the U.S.A

455,154. **Shoe Sole of Flexible Resinous Material Having a Base Ply Bearing an Insignia Protected by a Transparent Overlying Ply.** J. M. Bierer, Waban, assignor to Boston Woven Hose & Rubber Co., Cambridge, both in Mass., U.S.A.

455,176. **Filter Bag, Including a Pair of Perforate, Resilient, and Extensible Rubber Filtering Panels.** G. E. Shriver, Nutley, and J. U. Mann, Arlington, both in N. J., U.S.A., assignors to Dominion Rubber Co., Ltd., Montreal, P.Q.

455,179. **Mechanical Belt Formed of Plies of Woven Fabric Impregnated with Rubber and Bonded together.** R. D. Gartrell, Ridgewood, N. J., W. D. Carroll, Scottsville, Va., and A. W. Hansen, Jackson Heights, N. Y., all in the U.S.A., assignors to Dominion Rubber Co., Ltd., Montreal, P.Q.

455,181. **In a Laminated Article Consisting of a Sheet of Glass and a Sheet of Wood, an Interposed Sheet of Thermoplastic Material.** B. J. Dennison, Aspinwall, Pa., U.S.A., assignor to Duplicate Canada, Ltd., Oshawa, Ont.

455,190. **Composite Article, Including Polyvinyl Chloride Adhered to Vulcanized Natural Rubber.** G. H. Taft, Hudson, O., assignor to B. F. Goodrich Co., New York, N. Y., both in the U.S.A.

455,239 **Shock-Resistant Molded Product Having a Reinforcement of Randomly Arranged Pieces of Fabric Woven from Regenerated Cellulose, Bonded together by a Phenol-Formaldehyde Resin.** J. Allan, Spondon, England, assignor to C. Dreyfus, New York, N. Y., U.S.A.

455,357. **Rubber Vibration Absorbing Mounting.** G. H. Kaemmerling, assignor to Lord Mfg. Co., both of Erie, Pa., U.S.A.

455,381. **In a Pressure Device, a Container Sealed against Ambient Atmosphere, the Wall of Which Includes a Bimetal Helix Encased In Rubber Latex.** P. L. Spencer, West Newton, assignor to Raytheon Mfg. Co., Newton, both in Mass., U.S.A.

455,402. **Low Cut Rubber Overshoe.** W. C. Jackson, assignor to Tingley Reliance Rubber Corp., both of Rahway, N. J., U.S.A.

United Kingdom

616,653 **Laminated Driving Belts.** H. Brammer.

616,976. **Goggles, Particularly Adapted for Use as Water Goggles.** O. W. Heinz.

616,990. **Rubber-Soled Footwear.** Fabbriche Riunite Industria Gomma Torino Walter Marting Industria Gomma-Spiga-Saliet-Life.

617,012. **Plugs for Plug-and-Socket Closures for Wash-Basins, Baths, and Sinks.** E. E. Laver.

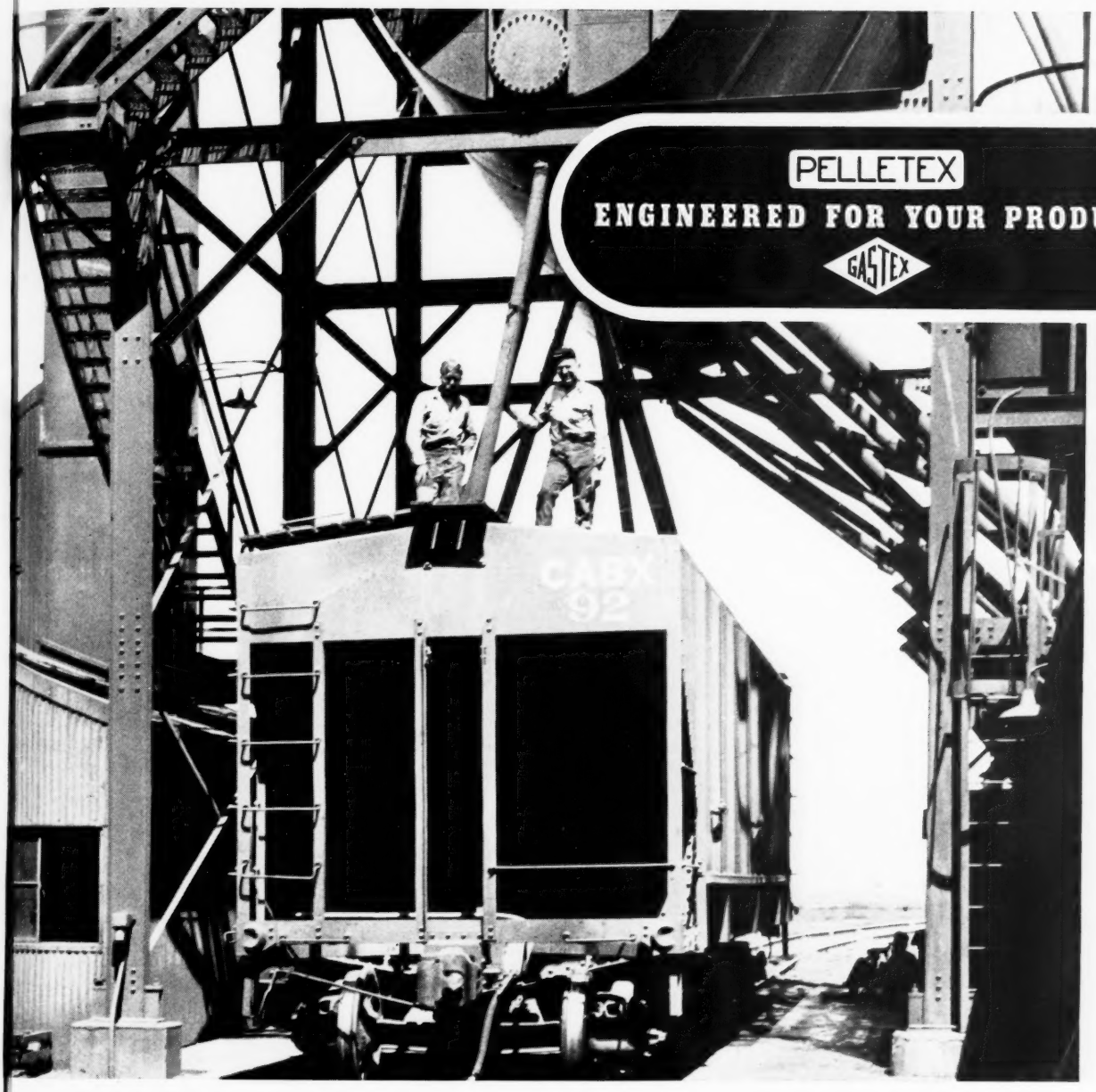
617,025. **Fire-Resisting Hose and the Like.** C. A. E. Oldham.

617,047. **Pneumatic Balloon-Tired Wheels for Vehicles and Aircraft.** F. Gonzalez-Cuesta.

617,528. **Flexible Bearings or Mountings.** Silentbloc, Ltd., and J. W. Moore.

617,543. **Rain Protectors for Bicycle Saddles.** K. G. Westrom and E. H. Thorell.

617,664. **Play Balls.** Dunlop Rubber Co., Ltd.



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General Atlas SRF carbon black being loaded into specially designed covered hopper cars for bulk shipment to rubber factories. Pelletex shipped in bulk or bags, by rail or road, always maintains the uniform high quality for which it is famous.

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The B. E. Dougherty Company, Los Angeles and San Francisco • Delacour-Gorrie Limited, Toronto

617,751. **Inflatable Members for Wheel Brakes.** Dunlop Rubber Co., Ltd., H. J. Butler, and H. F. L. Jenkins.

617,957. **Oil Sealing Ring.** General Tire & Rubber Co.

618,172. **Transmission Belt and Drive.** United States Rubber Co.

618,250. **Babies' Pacifiers.** D. Atkin.

618,561. **Collapsible Pneumatic Boats.** Soc. Zodiac.

PROCESS

United States

2,462,940. **Low-Pressure Molding of a Sheet of Plastic Composition of Thermosetting Resinous Binder and a Filler of Comparatively Long Vegetable Fibers.** P. E. Bowes, assignor to Columbian Rope Co., both of Auburn, N. Y.

2,463,261. **Making a Joint in Cables Having a Resin Insulation.** K. S. Wyatt, Bronxville, N. Y., assignor to Phelps Dodge Copper Products Corp., Dover, Del.

2,463,288-289. **Electrostatic Heating Method for Vulcanizing Rubber and Similar Material.** C. W. Leguillon, Akron, O., assignor to B. F. Goodrich Co., New York, N. Y.

2,464,060. **Forming Endless Belts of Plastic Useful as Sound Recording Media.** R. G. Rowe, New Haven, and G. B. Bona, Bridgeport, both in Conn., assignors to Dictaphone Corp., New York, N. Y.

2,464,746. **Moldable Thermoplastic Pellets.** H. Gering, Newark, assignor to Gering Products, Inc., Kenilworth, both in N. J.

2,465,126. **Recovering Rubber from Latex-Bearing Succulent Plants.** R. H. Stanton, San Marino, Calif.

Dominion of Canada

454,739. **High-Frequency Electrostatic Heating of Plastics.** H. F. MacMillin, Mt. Gilead, O., assignor to Hydraulic Development Corp., Wilmington, Del., both in the U.S.A.

454,834. **Reinforced Abrasive Article Having a Synthetic Rubber Tie Bond.** E. E. Howard, Buffalo, assignor to Carborundum Co., Niagara Falls, both in N. Y., U.S.A.

454,964. **Continuous Vulcanization of Insulated Electrical Conductors.** C. M. Canfield, Utica, assignor to General Cable Corp., New York, both in N. Y., U.S.A., assignor to Canada Wire & Cable Co., Ltd., Leaside, Ont.

454,965. **Making Laminated Fabrics by Bonding together Three Layers at Least Two of Which Have a Basis of a Thermoplastic Organic Film-Forming Polymer.** C. G. Bonard, London, England, administrator of the estate of H. Dreyfus, deceased, in his lifetime of London, assignor to Canadian Celanese, Ltd., Montreal, P.Q.

454,992. **Inflatable Tire Having an Abrasion-Resistant Anti-Skid Tread.** M. Mooney, Lake Hiawatha, E. M. Grabbe, Nutley, both in N. J., and G. G. Havens, San Diego, Calif., both in the U.S.A., assignors to Dominion Rubber Co., Ltd., Montreal, P.Q.

455,185. **Molding N-Vinyl Pyrrole Compounds.** W. F. Busse and J. M. Lambert, both of Easton, Pa., assignors to General Aniline & Film Corp., New York, N. Y., both in the U.S.A.

455,240. **Synthetic Resin Laminates.** J. Allan, Spondon, England, assignor to C. Dreyfus, New York, N. Y., U.S.A.

455,242. **Molding Composition.** J. Allan, Spondon, England, assignor to C. Dreyfus, New York, N. Y., U.S.A.

United Kingdom

616,996. **High-Frequency Dielectric Heating.** Standard Telephone & Cables, Ltd., A. J. Maddock, and K. M. Burtt.

617,659. **Flexible Cover for Tire Repair Vulcanizers.** General Tire & Rubber Co.

617,985. **Compounding, Mixing, and Sheeting Plastic Materials.** J. Ferguson & Sons, Ltd., and S. A. Ede.

618,124. **Molding Synthetic Resin Sheets.** Imperial Chemical Industries, Ltd., and R. A. Kinnear.

618,197. **Shaping Cellular Products of Artificial Resins.** Dunlop Rubber Co., Ltd., and M. Gordon.

618,614. **Applying Pigments to the Surfaces of Thermoplastic Materials.** D. O. Ford.

618,705. **Bonding Textile Yarns to Rubber.** Courtaulds, Ltd., and D. Entwistle.

CHEMICAL

United States

2,462,832. **Vulcanizing Natural Rubber and Butadiene-Styrene Rubber in the Presence of a Thiazole or Thiuram Accelerator and the Reaction Product of Tall Oil and Triethanolamine.** C. R. Johnson, Ridgewood, N. J.

2,462,895. **Polymeric Methyl Methacrylate with Increased Heat Resistance Obtained by Adding to an Aqueous Suspension thereof an Aliphatic Mercaptan.** J. L. Quinn, Matawan, N. J., assignor to E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

2,462,912. **Composition for Insulating Electric Equipment, Including a Melamine Aldehyde Resin, a Fatty Acid Ester Alkyd Resin and Ethyl Cellulose.** H. E. Smith and D. M. O'Halloran, both of Briarcliff Manor, assignors to Centro Research Laboratories, Inc., Scarborough on Hudson, both in N. Y.

2,463,023. **Coating Composition, Including a Fatty Oil and a Fatty Oil-Soluble Organic Resin, in Which Is Incorporated a Thermoplastic Agent from the Group of Water-Insoluble Cellulose Ethers, Polymerized Esters of Methacrylic Acid and Polymerized Vinyl Compounds.** R. S. Daniels, Union, and W. R. Catlow, Jr., Bloomfield, both in N. J., assignors to Bakelite Corp., a corporation of N. J.

2,463,032. **Urea- or Melamine-Formaldehyde Resin Plasticized with Polyacrylonitrile.** N. D. Hanson, Bloomfield, N. J., assignor to Bakelite Corp., a corporation of N. J.

2,463,219. **Improving the Milling Characteristics of Butadiene-Styrene Interpolymers, by Incorporating in the Interpolymer in Latex Form an Aryl Mercaptan and Thereafter Incorporating Oxygen.** J. H. Trepagnier, assignor to E. I. du Pont de Nemours & Co., Inc., both of Wilmington, Del.

2,463,224. **Preparation of Processing Agents for Use with Butadiene-Styrene Rubber, Which Includes Intimately Mixing in a Butadiene-Styrene Elastomer Paranitroso-Dimethylaniline, Nitroso-Beta-Naphthol, Phenylhydrazine or Thio-Alpha-Naphthol, and Exposing the Mixture to Oxygen.** J. R. Vincent, assignor to E. I. du Pont de Nemours & Co., Inc., both of Wilmington, Del.

2,463,225. **Preparation of Butadiene Rubbers, Which Includes Polymerizing in the Presence of a Polymerization Modifier of the Formula R—CI_3, in Which R Is a Substituent of the Group of —H, —I and CH_3.** J. R. Vincent, Newport, Del., assignor to E. I. du Pont de Nemours & Co., Inc., Wilmington.

2,463,282. **Coating Composition, Including a Partially Hydrolyzed Ethylene/Vinyl Acetate Copolymer and an Anti-Static Agent Consisting of an Alkyl Pyridinium Chloride Having 8-18 Carbon Atoms in the Alkyl Radical.** B. P. Kang, Kearny, N. J., assignor to E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

2,463,452. **Removable Adhesive Sheet, Including a Fibrous Backing Material Having a Tacky Coating Including Polyisobutylene Having a Molecular Weight of 80,000 to 100,000, Dibutyl Sebacate as an Anti-Adhesive Transfer Agent and Mineral Oil as an Extender.** G. W. Yule, Leominster, Mass., assignor to E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

2,463,456. **Nitriles.** W. I. Denton, Woodbury, and R. B. Bishop, Haddonfield, both in N. J., assignors to Socony-Vacuum Oil Co., Inc., a corporation of N. Y.

2,463,466. **Nitriles.** M. M. Marisic, Northfield, Ill., W. I. Denton, Woodbury, and R. B. Bishop, Haddonfield, both in N. J., assignors to Socony-Vacuum Oil Co., Inc., a corporation of N. Y.

2,463,500. **Thiophenealdehydes and Thiophene Carboxylic Acids.** H. D. Hartough, Pitman, N. J., assignor to Socony-Vacuum Oil Co., Inc., a corporation of N. Y.

2,463,501. **Para Phenyl Phenol Resins.** J. A. Arvin, Homewood, Ill., assignor to Sherwin-Williams Co., Cleveland, O.

2,463,571-575. **Vulcanizable Interpolymers from Aqueous Dispersions of Mixtures of Vinylidene Chloride, Butadiene and Isobutylene, Vinylidene Chloride, Butadiene and Vinyl Acetate, Vinylidene Chloride, Butadiene and Vinyl Chloride, Vinylidene Chloride, Butadiene and Alpha-Methyl Styrene, and Vinylidene Chloride, Butadiene and Ethyl Acrylate.** G. W. Stanton and C. E. Lowry, assignors to Dow Chemical Co., all of Midland, Mich.

2,463,596. **Preparing Polycyclopentadiene of High Molecular Weight by Dissolving Cyclopentadiene in a 2-Haloalkene-1, and Polymerizing at —80 to 25° C. with a Catalyst from the Class of Tin Tetrachloride, Aluminum Bromide, Aluminum Chloride, Boron Chloride, and Boron Fluoride.** G. B. Butler, assignor, by mesne assignments, to Rohm & Haas Co., both of Philadelphia, Pa.

2,463,608. **Purifying Acrylic Esters.** M. L. Fein, Riverside, N. J., and C. H. Fisher, Abington, Pa., assignors to United States of America, as represented by the Secretary of Agriculture.

2,463,829. **Plasticized Elastomer Compositions.** P. F. Tryon, assignor to Commercial Solvents Corp., both of Terre Haute, Ind.

2,463,846. **Purification of Solvent Used in Butadiene Extraction.** F. A. Bain and H. R. Emmerson, Ontario, Canada, assignors to Standard Oil Development Co., a corporation of Del.

2,463,866. **In the Production of Olefinic Elastomers, Forming a Slurry of Solid Polymer Particles in Cold Reaction Liquid and Discharging the Cold Slurry in an Enclosed Quenching Zone into a Heated, Well-Agitated Aqueous Liquid to Flash off the Volatile Reaction Liquid and Separating the Polymer Particles from This Liquid.** A. D. Green, Cranford, N. J., assignor to Standard Oil Development Co., a corporation of Del.

2,463,897. **Thermoplastic Resin Consisting of Polymerized Nuclear Trichlorostyrene.** J. C. Michalek, Niagara Falls, assignor to Mathieson Chemical Corp., New York, both in N. Y.

2,463,902. **Separation and Recovery of Butadiene from an Alkaline Aqueous Cuprous Salt Solution in Which It Is Absorbed with Butenes.** M. A. Payne, Baton Rouge, La., assignor to Standard Oil Development Co., a corporation of Del.

2,463,952. **Composition Including Plasticized, Granulated Cork Particles Mixed with a Vinyl Ester Resin and a Compatible Plasticizer.** G. B. Cooke, assignor to Crown Cork & Seal Co., Inc., both of Baltimore, Md.

2,463,974. **Film-Forming, Heat-Resistant Insulating Materials from a Composition Including a Resinous Polymeric Organo-Silicon Oxide Condensation Product and Ethyl Cellulose.** O. K. Johannson, assignor to Corning Glass Works, both of Corning, N. Y.

2,463,977. **Polymers from a Heated Mixture Including a Monoaminomonohydric Alcohol, an Aliphatic Dicarboxylic Acid and an Aliphatic Monohydroxymonocarboxylic Acid.** E. L. Kropa, Old Greenwich, Conn., assignor to American Cyanamid Co., New York, N. Y.

2,464,033. **Obtaining Increased Yields of Dialkyldihalogenosilanes.** W. F. Gilliam, Schenectady, N. Y., assignor to General Electric Co., a corporation of N. Y.

2,464,056. **Polymerizing a Chloroformate of an Unsaturated Monohydric Alcohol in the Presence of an Organic Percarbonate Ester.** A. Pechukas, Akron, O., assignor to Pittsburgh Plate Glass Co., Pittsburgh, Pa.

2,464,062. **Polymerization with a Peroxydicarbonate Catalyst.** F. Strain, Norton Center, O., assignor to Pittsburgh Plate Glass Co., a corporation of Pa.

2,464,120. **Polymers of Alpha-Fluoroacetoxy-Acrylonitrile Compounds.** J. B. Dickey and T. E. Stanin, assignors to Eastman Kodak Co., all of Rochester, N. Y.

2,464,177. **Vinyl Chloride Resins Stabilized Against Discoloration at Elevated Temperatures by Alkali Metal or Alkaline Earth Metal Salts of Nitro Substituted Alkanes Having from 2 to 4 Carbon Atoms.** J. K. Fincke, Dayton, O., assignor to Monsanto Chemical Co., St. Louis, Mo.

2,464,219. **Molding Composition Including a Polyvinyl Chloride Resin and an Asphaltic Material.** P. C. Doyle, Rocky River, and K. H. Rudd, Cleveland Heights, assignors to Standard Oil Co., Cleveland, all in O.

2,464,231. **Preparation of Pentamethylene Silicone Polymers.** J. M. Hersh, assignor to Continental Oil Co., both of Ponca City, Okla.

2,464,244. **Methyl Vinyl Ketone.** I. E. Levine and W. G. Toland, Jr., both of Berkeley, assignors to California Research Corp., San Francisco, both in Calif.

2,464,250. **Polymeric Vinylidene Chloride Compositions Containing a Light Stabilizer.** H. W. Moll and E. C. Britton, assignors to Dow Chemical Co., all of Midland, Mich.

2,464,263. **Molding Composition Including a Polyvinyl Resin and a Cracked Petroleum Residuum.** K. H. Rudd, Cleveland Heights, assignor to Standard Oil Co., Cleveland, O.

2,464,455. **Electrical Insulation Consisting of Non-Rigid, Non-Flame-Supporting Polyvinyl Chloride Composition Plasticized with a Mixture of Hydrocarbon Products of Condensation Reaction between Formaldehyde and an Aromatic Petroleum Fraction with an Ester of Phthalic Acid.** W. B. MacKenzie, Yonkers, N. Y., assignor to Phelps Dodge Copper Products Corp., Dover, Del.

2,464,488. **Copolymer of Diallyl Chloromaleate and Butadiene-1,3.** A. M. Clifford, Stow, and J. D. D'Ianni, assignors to Wingfoot Corp., both of Akron, both in O.

2,464,519. **Production of a Dicarbamate by Reacting Diallyl Carbonate with a Diamine.** J. G. Lichty and N. V. Seeger, both of Cuyahoga Falls, assignors to Wingfoot Corp., Akron, both in O.

2,464,520. **Desulfurizing an Aromatic Hy-**

RECIPE

(Test No. 8421 from the Barrett Rubber Research Laboratory)

FOR

CUMAR*

RESIN, MH 2½ GRADE IN A Natural Rubber, Non-Tarnishing Black Gasket Compound

CUMAR* resin, MH 2½ grade, is well adapted for use in compounds that will not cause tarnishing when used in contact with silvered surfaces such as reflectors of headlamps and spotlights. Its behavior as an effective softener and extender for natural rubber recommends its application on the basis of economy as well as quality and performance. For smooth and safe processibility, for the retention of physical properties, and for essentially non-staining and non-migrating purposes, CUMAR* resin, MH 2½ grade, is well qualified to assist the compounder in the design of recipes for general and specific applications.

Compound No. 8421—LTO

Smoked Sheets	100.0
CUMAR* Resin, MH 2½ grade	10.0
Calcium Carbonate (Precipitated)	100.0
Furnace Black (HMF)	10.0
"DIXIE" Clay	40.0
Zinc Oxide	5.0
Stearic Acid	2.0
"B-L-E" 25	1.0
"SUNPROOF"	1.0
Sulfur	0.1
Ethyl "SELENAC"	1.0
Mercaptobenzothiazole	0.5
	Total 270.6
Specific Gravity	1.49
RHC, % by weight	37.0
RHC, % by volume	59.6
Mooney Viscosity, ML, 212 F. at 4 minutes	26

Mooney Scorch, MS, 220 F.:

Minutes	Viscosity
1	16
10	15
20	15

Press Cure at 316 F. (70 lb.)—10 Minutes	Unaged	Aged 70 Hours at 70 C.
Tension and Hardness Data:		
Stress at 300%, psi.	700	1000
Stress at 500%, psi.	1600	1950
Tensile, psi.	1900	2100
Elongation, %	550	510
Hardness, Shore A	55	60
Tear Resistance, Angle, Pounds per One Inch Thickness	90	105
Compression Set†, 40% Constant Deflection, %	29.3	—
Resilience, †(Yerzley), % Energy Recovery	43.4	53.3
Impact Resilience †(G-H), % Rebound	47.8	52.5

†Specimens cured 15 minutes at 316 F. (70 lb.)

THE BARRETT DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 Rector Street, New York 6, N. Y.
In Canada: The Barrett Company, Ltd.,
5551 St. Hubert St., Montreal, P. Q.

drocarbon Containing Thiophene. A. P. Lien, Hammond, Ind., and R. L. Evering, assignors to Standard Oil Co., both of Chicago, Ill.

2,464,568. **Electrical Coil Having an Insulation of Particles of a Thermoplastic Polymeric Material Intimately Associated with the Product of Polymerization of Polymerizable Unsaturated Alkyd Resin and a Liquid Monomer Containing a Copolymerizable Ethylenic Linkage.** E. J. Flynn and F. J. Lasak, both of Schenectady, N. Y., assignors to General Electric Co., a corporation of N. Y.

2,464,693. **Synthetic Linear Polycarbonamides.** W. Kirk, Jr., and R. S. Schreiber, assignors to E. I. du Pont de Nemours & Co., Inc., all of Wilmington, Del.

2,464,717. **Reaction Product Produced by Heating under Pressure at above 300° F. Completely Saponified Polyvinyl Alcohol, Furfural, and Formaldehyde.** C. A. Porter, assignor to Resinoflex Corp., both of Belleville, N. J.

2,464,723. **Improved, Continuous Process for Producing Unsaturated Nitriles by the Interaction of a Conjugated Diolefin and an Unsaturated Nitrile.** W. A. Schulze and J. E. Mahan, both of Bartlesville, Okla., assignors to Phillips Petroleum Co., a corporation of Del.

2,464,741. **Heating Allyl Glycolate in Liquid Phase in the Presence of a Peroxide Polymerization Catalyst to Produce Polyallyl Glycolate.** D. E. Adelson and H. Dannenberg, both of Berkeley, assignors to Shell Development Co., San Francisco, both in Calif.

2,464,742. **Copolymer from an Open-Chain 1,3-Diene Hydrocarbon of 4 to 5 Carbon Atoms, and a Mixture of 2-Methyl-1,3-Pentadiene and 4-Methyl-1,3-Pentadiene.** E. T. Bishop, Berkeley, assignor to Shell Development Co., San Francisco, both in Calif.

2,464,747. **Vinyl Ether-Phosgene Interpolymerization Products.** F. Grosser, Easton, Pa., assignor to General Aniline & Film Corp., New York, N. Y.

2,464,753. **Allyl Glycidyl Mixed Diether of Bis- (4-Hydroxyphenyl)-2,2-Propane and Polymers thereof.** E. C. Shokal, Oakland, and L. N. Whitehill, Berkeley, assignors to Shell Development Co., San Francisco, all in Calif.

2,464,772. **Sponge-Forming Composition, Including Viscose, Reinforcing Fibers and a Pore Forming Substance.** N. Drisch, assignor, by mesne assignments, to Société Novacel, both of Paris, France.

2,464,783. **Neoprene Rubber-Coated Phenolic Resin-Saturated Sheet.** E. R. Dillehay, Glen Ellyn, Ill., assignor to Richardson Co., Lockland, O.

2,464,789. **Organic Polysulfides.** J. L. Eaton, Trenton, Mich., assignor to Sharples Chemicals, Inc., a corporation of Del.

2,464,855. **Vinyl Resin Composition Including a Plasticizer and, as Anti-Block Agent, a Stearic Acid Amide of Ethylene Diamine.** F. W. Duggan, Bennington, Vt., and R. P. Stambaugh, Bound Brook, N. J., assignors to Bakelite Corp., a corporation of N. J.

2,464,869. **Producing 1,1,1-Trichloro-5-Bromo-2,3-Dicarbalkoxy Alkanes, Substituted 1,1,1-Trichloro-5-Bromo-2, 3-Dicarbalkoxy Alkanes and Their Dehydrobrominated Derivatives by Heating a Mixture Containing a 1,1,1-Trichloro-3-Bromo-2, 3-Dicarbalkoxy Propane, a Terminally Unsaturated Olefin and a Peroxidic Polymerization Catalyst.** M. S. Kharasch, Chicago, Ill., assignor to United States Rubber Co., New York, N. Y.

2,465,072-073. **Compositions Including Polyvinyl Compound, Natural or Synthetic Rubber, Plasticized with a Non-Drying Trimer of the Group of the Trimers of Methyl Amyl Ketone and Methyl Hexyl Ketone.** B. A. Dombrow, New York, and J. J. Miskel, Brooklyn, both in N. Y., assignors to Napco Chemical Co., Harrison, N. J.

2,465,122. **Copolymers of Styrene and 2,5,2',5'-Tetrachloro-4,4'-Divinyl-Biphenyl.** F. Rosenthal, Crescent Park, N. J., assignor to Radio Corp. of America, a corporation of Del.

2,465,150. **Highly Polymeric, Linear Diphenoxy-n-Alkane-4,4'-Dicarboxylic Esters.** J. T. Dickson, Tranent, East Lothian, Scotland, assignor, by mesne assignments, to E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

2,465,205. **Reclaiming a Vulcanized Copolymer of Butadiene and Acrylonitrile with the Aid of an Acrylic Ester.** P. J. Dasher, Willoughby, O., assignor to B. F. Goodrich Co., New York, N. Y.

2,465,285. **Aqueous Polyvinyl Acetate Emulsion in Which Is Incorporated a Water Soluble Dichromate of a Trivalent Metal as a Hardening Agent.** F. A. Strauss, Staten Island, N. Y., assignor to American Abrasive Metals Co., Irvington, N. J.

2,465,296. **Composition Including an Organosilicon Oxide Polymer and a Minor Proportion of a Metal Chelate.** J. Swiss, McKeesport, assignor to Westinghouse Electric Corp., East Pittsburgh, both in Pa.

2,465,299. **In a Laminated Member Including Fibrous Material, a Low Order Phenol-Formaldehyde Resin as Bonding Agent.** J. J. Wachter, Wilkinsburg, assignor to Westinghouse Electric Corp., East Pittsburgh, both in Pa.

2,465,316. **Vinyl Halo Benzoates.** D. T. Mowry and G. E. Ham, both of Dayton, O., assignors to Monsanto Chemical Co., St. Louis, Mo.

2,465,317. **Vinyl Alkoxy Benzoates.** D. T. Mowry and G. E. Ham, both of Dayton, O., assignors to Monsanto Chemical Co., St. Louis, Mo.

2,465,318. **Products Which When Molded Have Higher Impact Strength Than That of Molded Polystyrene, Obtained by Heating a Mixture of Piperylene or Its Monomethyl Homologs and an Unsaturated Nitrile.** R. B. Seymour, Dayton, O., assignor to Monsanto Chemical Co., a corporation of Del.

2,465,319. **A Series of Highly Polymeric Linear Terephthalic Esters.** J. R. Whinfield, Accrington, England, and J. T. Dickson, East Lothian, Scotland, assignors, by mesne assignments, to E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

2,465,336. **Preparing Coated Fabrics by Milling a Composition Containing Chlorine-2-Butadiene 1,3, Zinc Oxide, Magnesium Oxide, Calcium Carbonate and Pigments, and Adding Chlorinated Polyethylene and a Solvent.** R. N. MacDonald, New Castle, and H. S. Rothrock, assignors to E. I. du Pont de Nemours & Co., Inc., both of Wilmington, both in Del.

2,465,363. **Synthetic Elastomers.** W. F. Faragher, Swarthmore, Pa., and J. W. Harrison, Woodbury, N. J., assignors to Houdry Process Corp., Wilmington, Del.

2,465,486. **Molding Composition, Including Ethyl Cellulose, Dibutyl Phthalate, Refined Mineral Oil, and, as Color Stabilizing Agent, Citric Acid.** W. D. Paist, Orange, N. J., assignor to Celanese Corp., of America, a corporation of Del.

2,465,486. **Preparation of 4,4'-Divinyl-Diphenyl.** F. Rosenthal, Crescent Park, N. J., assignor to Radio Corp. of America, a corporation of Del.

2,465,512-513. **Polysulphide Coating and Sealing Material.** F. M. Carasso, Pasadena, assignor to Lockheed Aircraft Corp., Burbank, both in Calif.

2,465,547. **Hexadecamethylcyclooctasiloxane.** R. R. McGregor, Verona, and E. L. Warrick, both in Pa., assignors, by mesne assignments, to Corning Glass Works, Corning, N. Y.

2,465,552. **Polysulfide Coating and Sealing Compound.** P. M. Reedy, Jr., assignor to Lockheed Aircraft Corp., both of Burbank, Calif.

2,465,710. **Sulfur-Set Furfuryl Alcohol Resins.** J. J. Clancy, Millis, assignor to Arthur D. Little, Inc., Cambridge, both in Mass.

2,465,715, 2,465,718. **Isolation of Styrene by Azeotropic Distillation.** K. H. Engel, Teaneck, N. J., assignor to Allied Chemical & Dye Corp., New York, N. Y.

2,465,731. **Allyl Chloro Silicanes.** E. L. Kropa, Old Greenwich, Conn., assignor to American Cyanamid Co., New York, N. Y.

2,465,858. **Flexible, Resilient Shape Formed from a Mixture of Mineral Filler Particles Suspended in a Polymerized Resorcinol-Coupled Linseed Oil and Mineral Fibers, the Whole Bonded by a Phenol-Aldehyde Resin.** J. H. Ferguson, Somerville, N. J., assignor to Johns-Manville Corp., New York, N. Y.

2,465,888. **Emulsion Polymerization of Butadiene in the Presence of an Alkali Salt of an Alkyl Ester of the Addition Product of Levopimaric Acid and Maleic Anhydride.** R. V. Lawrence, New Orleans, La., assignor to the United States of America, as represented by the Secretary of Agriculture.

2,465,901. **Copolymerizing Butadiene and Styrene in an Aqueous Emulsion Containing an Emulsifying Soap and an Alkali Salt of the Addition Product of Levopimaric Acid and Maleic Anhydride.** F. L. McKennon and R. V. Lawrence, both of New Orleans, La., assignors to United States of America, as represented by the Secretary of Agriculture.

2,465,915. **Thermoplastic Cellulose Derivative Including, as a Color Stabilizing Agent, a Polyhydroxy Alcohol Ester of Sulfurous Acid.** W. J. Myles, Summit, and J. H. Prichard, Springfield, both in N. J., assignors to Celanese Corp. of America, a corporation of Del.

2,465,958. **Preparation of Nitro Amines.** M. Senkus, assignor to Commercial Solvents Corp., both of Terre Haute, Ind.

Dominion of Canada

454,723 **Resolving a Mixture of Tetrachlorosilane and Trimethylchlorosilane by Fractional Distillation in the Presence of Acetonitrile or Acrylonitrile.** R. O. Sauer, and C. E. Reed, both of Schenectady, N. Y., U.S.A., assignors to Canadian General Electric Co., Ltd., Toronto, Ont.

454,745. **Separation of Butadiene from Butylenes with Selective Solvents.** T. W. Evans, Oakland, and R. C. Morris, Berkeley, assignors to Shell Development Co., San Francisco, all in Calif., U.S.A.

454,753. **On a Textile Fabric Non-Sticky Coating Which Can Be Stiffened under Evaporation Conditions, and Includes a Cellulose Acetate Dope Containing Polyglycerol Acetate as Plasticizer and Acetone and a High Boiling Solvent for the Cellulose Acetate.** W. H. Moss, London, England, assignor to C. Dreyfus, New York, N. Y., U.S.A.

454,810. **Resinous Copolymer of Isopropenyl Acetate and an Ester of a Monohydric Alcohol and Maleic Acid, or an Ester of a Monohydric Alcohol and Fumaric Acid.** W. O. Kenyon and C. C. Unruh, both of Rochester, N. Y., U.S.A., assignors to Canadian Kodak Co., Ltd., Toronto, Ont.

454,832. **Plastic Composition Containing a Resinous Partial Acetal of Polyvinyl Alcohol and an Aliphatic Monoaldehyde Combined with Glyoxal or Methyl Glyoxal.** H. D. Cogan, Glenshaw, and R. W. Quarles, Pittsburgh, both in Pa., U.S.A., assignors to Carbide & Carbon Chemicals, Ltd., Toronto, Ont.

454,833. **In an Abrasive Article, a Resilient Tie Bond Layer Consisting Essentially of a Mixture of Polychloroprene and a Phenolic Resin.** J. A. Prentice, assignor to Carborundum Co., Niagara Falls, N. Y., U.S.A.

454,835. **Bonded Abrasive Article, Including Abrasive Particles and a Copolymer of a Diolefinic Monomer with a Halogen-Substituted Olefinic Compound.** C. E. Wooddell, G. Van Nimwegen, and E. T. Hager, assignors to Carborundum Co., all of Niagara Falls, N. Y., U.S.A.

454,942. **Salts of a Carboxy Polymethylene Guanamine.** J. T. Thruston, Cos Cob, Conn., assignor to American Cyanamid Co., New York, N. Y., U.S.A.

454,974. **Completely Acetone-Soluble Copolymer of Vinyl Chloride and Acrylonitrile.** L. C. Shriver, South Charleston, W. Va., and G. H. Fremon, Charleston, Va., both in the U.S.A., assignors to Carbide & Carbon Chemicals, Ltd., Toronto, Ont.

454,975. **Dispersion of a Copolymer of Vinyl Chloride with Vinyl Acetate Prepared by Grinding the Copolymer at a Temperature below 50°C. with a Dispersant Consisting of a Mixture of a Liquid Ketone and Liquid Hydrocarbons.** C. I. Spessard, Pittsburgh, Pa., U.S.A., assignor to Carbide & Carbon Chemicals, Ltd., Toronto, Ont.

454,985. **Dispersion of Rubber in a Polar Organic Liquid Which Is Non-Solvent for Rubber and in Which the Rubber Is Associated with a Colloid Capable of Being Swollen by the Polar Organic Liquid.** C. H. Egan, Belmont, A. J. Leydon, Waltham, and J. P. Fahey, Cambridge, all in Mass., U.S.A., assignors to Dewey & Almy Chemical Co. of Canada, Ltd., Ville La Salle, P.Q.

455,048. **Resin-Impregnated Laminated Fabrics Prepared by Dispersing a Fusible Polymer of an Ester Containing Two Active Unsaturated Groups in the Interstices of the Fabric, the Polymer Containing Polymerization Catalyst, and Heating under Pressure to Polymerize Further.** M. A. Pollack, I. E. Muskat, and F. Strain, all of Akron, O., assignors to Pittsburgh Plate Glass Co., Pittsburgh, Pa., both in the U.S.A.

455,067. **Vinyl Chloride by Pyrolysis of Dichloroethane.** V. Collard, Uccle Bruxelles, assignor to Solvay & Cie, Ixelles-Bruxelles, both in Belgium.

455,087. **Resin Composition Color-Stable at 300°F., Including a Resin Containing Vinyl Chloride Polymer, Zinc Stearate, and Alkali Metal or Alkaline Earth Metal.** E. Cousins, assignor to Wingfoot Corp., Akron, O., U.S.A.

455,201. **Vulcanized Furfuryl Alcohol Resin.** J. J. Clancy, Millis, assignor to Arthur D. Little, Inc., Cambridge, both in Mass., U.S.A.

455,221. **Polymerized Mixture of a Copolymer of Vinylidene Chloride and Methyl Methacrylate, and Monomeric Methyl Methacrylate.** W. L. J. de Nie, Amsterdam, Netherlands, assignor to Shell Development Co., San Francisco, Calif., U.S.A.

455,227. **Cyclic Process for the Production of Dienes with Substantial Yields of Resin- and Non-Resin-Forming Aromatic Hydrocarbons.** N. K. Chaney, Moylan, Pa., and E. L. Hall, Manchester, N. H., assignors to United Gas Improvement Co., Philadelphia, Pa., both in the U.S.A.

455,331. **Lightweight Cellular Product Which Is the Heat-hardened Product of a Gelled Foam of an Aqueous Emusion Including a Urea-Formaldehyde Resin, and Acrylic Acid Ester, and a Vinyl Ester of a Lower Aliphatic Acid.** L. E. Daly, Osceola, Ind., U.S.A., assignor to Dominion Rubber Co., Ltd., Montreal, P.Q.

455,340. **Processing a Rubbery Vinyl Alkyl Ether Polymer Containing an Agent Increasing Its Resistance to Depolymerization by Heat by Milling on Rolls at 40 to 150° C.** I. V. Runyan, Easton, Pa., assignor to Gen-

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eral Aniline & Film Corp., New York, N. Y., both in the U.S.A.

455,341. **Producing a Dispersion of Carbon Black in a Synthetic Rubber.** T. A. TeGrotenhuis, Olmsted Falls, and C. B. Frost, assignors to General Tire & Rubber Co., both of Akron, O., both in U.S.A.

455,354. **Fusible Thermoplastic Composite Resin Containing an Aromatic Amine-Aldehyde Resin and a Fusible Resorcin-Aldehyde Resin.** P. H. Rhodes, East Hampton, N. Y., assignor to Pennsylvania Coal Products Co., Petrolia, assignor to Koppers Co., Inc., Pittsburgh, both in Pa., both in the U.S.A.

455,359. **Distillation of Monomeric Dichlorostyrene.** E. R. Erickson, Niagara Falls, assignor to Mathieson Alkali Works, New York, both in N. Y., U.S.A.

455,363. **Adhesive Film Made from an Amorphous, Potentially Viscid Polymeric Material and a Latent Crystalline Plasticizer.** L. M. Perry, assignor to Nashua Gummed & Coated Paper Co., Nashua, N. H., U.S.A.

455,395. **Plastic Composition Including a Normally Hard, Brittle Polyamide Resin and a Plasticizing Amount of Styrene-Isobutylene Copolymer.** D. W. Young, Roselle, and W. J. Sparks, Cranford, assignors to Standard Oil Development Co., Linden, all in N. J., U.S.A.

455,406. **Converting Aliphatic Monoolefins Having Less than 6 Carbon Atoms in Straight Chain Arrangement into Diolefins.** A. V. Grosse, Bronxville, N. Y., assignor to Universal Oil Products Co., Chicago, Ill., both in the U.S.A.

United Kingdom

616,647. **Synthetic Rubber.** Wingfoot Corp.

616,742. **Molding Powders from Aldehyde Resins and Acid Treated Fibers.** H. W. Chatfield.

616,751. **Direct Production of Aromatic Vinyl Compounds and Polymers thereof.** Dominion Tar & Chemical Co., Ltd.

616,782. **Chlorinated Derivatives of 2:5-Dihydrofuran.** Distillers Co., Ltd., and T. Henshall.

616,844. **Styrene and Styrene Compounds.** L. E. Jones (Carbide & Carbon Chemicals Corp.).

616,849. **Polymerizable Fluorine-Containing Esters, Polymers, and Interpolymers.** Imperial Chemical Industries, Ltd., and J. W. C. Crawford.

616,886. **Synthetic Rubber Compositions.** J. Arnold (Standard Oil Development Co.).

616,894. **Direct Synthesis of Alkyl Substituted Styrene Polymers.** Dominion Tar & Chemical Co., Ltd.

616,904. **Organic Nitriles.** British Resin Products, Ltd., E. M. Evans, and H. Thurston-Hookway.

616,927. **Hydrolyzed Interpolymers of Vinyl Fluoride with Vinyl Esters.** E. I. du Pont de Nemours & Co., Inc.

617,052. **Polymerized Ethylene in Powder Form.** Telegraph Construction & Maintenance Co., Ltd., H. F. Wilson, and B. Allwright.

617,090. **Butadiene.** British Celanese, Ltd.

617,273. **Vulcanization of Rubber Compositions.** Wingfoot Corp.

617,285. **Recovery of Polymers from Aqueous Dispersions thereof.** British Celanese, Ltd.

617,311. **Hydrogenated Polymers.** British Thomson-Houston Co., Ltd.

617,335. **Vinyl Chloride.** B. F. Goodrich Co.

617,342. **Solid Dimer of Alpha-Methyl Paramethyl Styrene.** Standard Telephones & Cables, Ltd.

617,351. **Hydrocarbon Polymers.** J. C. Arnold (Standard Oil Development Co.).

617,371. **Coloration of Articles Including Synthetic Polymers.** Imperial Chemical Industries, Ltd., and A. M. Wooler.

617,488. **Resinous Condensation Products.** C.U.R.A. Patents, Ltd., and G. H. Thomson.

617,506. **Phenolic Resin Adhesive.** I. F. Laucks, Inc.

617,508. **Compositions Including Halogen-Containing High Molecular Substances.** N. V. De Bataafsche Petroleum Mfg.

617,570. **Foils and Films of Polymeric n-Vinyl Pyrrole Compounds.** General Aniline & Film Corp.

617,572. **Stabilization of Halogeno-Organic Compounds.** Mathieson Alkali Works.

617,605. **Resin Molding Compositions.** Imperial Chemical Industries, Ltd., and T. Ward.

617,620. **Stabilized Compositions Containing Polymers Which Evolve Hydrogen Chloride on Decomposition.** N. V. De Bataafsche Petroleum Mfr., P. G. White, and P. J. Garner-Croft.

617,632. **Synthetic Resinous Compositions.** British Resin Products, Ltd., E. M. Evans, and J. F. Williams.

617,779. **After-Treatment of Copolymers.** J. C. Arnold (Standard Oil Development Co.).

617,820. **Dichlorovinyl Ethers.** Ciba, Ltd.

617,891. **Copolymerization Products of Homogeneous Composition.** N. V. De Bataafsche Petroleum, Mij.

617,907. **Aqueous Dispersions of Synthetic Linear Polyamides.** Imperial Chemical Industries Ltd. (E. I. du Pont de Nemours & Co., Inc.).

617,931. **Cellulose Esters.** J. J. Allen and J. A. Hawkes.

617,934. **Frosting the Surface of Thermoplastic Materials.** D. O. Ford.

618,049. **Moistureproof Film.** Firestone Tire & Rubber Co.

618,093. **Impregnating and Adhesive Compositions.** Imperial Chemical Industries, Ltd., and T. J. B. Arthur.

618,094. **Plastic Compositions Containing Glass Fiber.** E. I. du Pont de Nemours & Co., Inc.

618,168. **Polymerization of Compounds Containing the Ethylenic Double Bond.** Imperial Chemical Industries, Ltd., L. Marshall, I. Harris, and K. B. Jarrett.

618,175. **Polyvinyl Amine Compounds.** Kodak, Ltd.

618,195. **Solutions or Dispersions of Linear Super Polyamides and the Treatment of Fibrous Materials therewith.** Tootal Broadhurst Lee Co., Ltd., R. P. Foulds, and W. H. Roscoe.

618,245. **Sulfurized Terpene Products and Oils Containing Them.** E. I. du Pont de Nemours & Co., Inc.

618,249. **Low-Temperature Olefinic Polymers.** J. C. Arnold (Standard Oil Development Co.).

618,251. **Cation-Exchange Resins.** Permutit Co., Ltd., and T. R. E. Kressman.

618,295. **Process for Increasing the Rate of Polymerization of Diallyl Phthalate.** N. V. De Bataafsche Petroleum Mij.

618,299. **Concentrating Synthetic Latex.** B. F. Goodrich Co.

618,345. **Securing Adhesion between Polyethylene and Other Materials.** C. E. Richards, R. L. Bull, and R. F. Wilson.

618,375. **Coagulants for Rubber Latex and the Coagulation of Rubber Latex therewith.** D. Outon-Powell.

618,390. **Sulfur-Containing Dicarboxylic Acids.** B. F. Goodrich Co.

618,403. **A Monaryl-Dihalosilane.** Dow Chemical Co.

618,426. **Tacky Rubber-Like Material.** Firestone Tire & Rubber Co.

618,440. **Sulfur-Containing Organic Polymers.** Dunlop Rubber Co., Ltd., and M. Goldstaub.

618,449. **Sulfur-Containing Organic Polymers and Cold Setting Products Obtained therefrom.** Dunlop Rubber Co., Ltd., and M. Goldstaub.

618,451. **Methyl Silicone Elastomers Containing si-Bonded Vinyl Radicals.** British Thomson-Houston Co., Ltd.

618,452-453. **Methyl Silicone Gums and Elastomers.** British Thomson-Houston Co., Ltd.

618,459. **Organo-Siloxanes.** J. G. Fife (Dow Chemical Co.).

618,478. **Stabilization of Nuclear Chlorostyrenes.** Mathieson Alkali Works.

618,480. **Silicone Polymers.** Westinghouse Electric International Co.

618,550. **Electrical Insulating Material.** B. F. Goodrich Co.

618,608. **Alkenyl-Substituted Chlorosilanes.** British Thomson-Houston Co., Ltd.

618,613. **Biguanide Derivatives.** Imperial Chemical Industries, Ltd., A. F. Crowther, F. H. S. Curd, F. L. Rose.

618,674. **Catalytic Polymerization of Hydrocarbons.** Phillips Petroleum Co.

618,691. **Acrylate Ester Polymers.** J. C. Arnold (Standard Oil Development Co.).

618,829. **Dyeing Polyvinyl Derivatives.** Soc. Rhodiaceta.

618,839. **Polymers of Ethylene.** E. I. du Pont de Nemours & Co., Inc.

MACHINERY

United States

2,463,288. **Apparatus for Vulcanizing Rubber and Similar Material by Electrostatic Heating.** C. W. Leguillon, Akron, O., assignor to B. F. Goodrich Co., New York, N. Y.

2,463,289. **Apparatus to Produce Cellular Rubber Material by Electrostatic Heating.** C. W. Leguillon, Akron, O., assignor to B. F. Goodrich Co., New York, N. Y.

2,463,560. **Vulcanizer.** D. G. Rempel, Akron, assignor to Sun Rubber Co., Barberton, both in O.

2,464,020. **Tire Building Machine.** W. J. Breth, assignor to General Tire & Rubber Co., both of Akron, O.

2,464,092. **Machine for Frictionally Stretching and Mounting Solid Resilient Tires on Rims.** S. and N. J. Kroll, both of Chicago, Ill.

2,464,232. **Tire Vulcanizer.** H. B. Hudson, assignor of one-half to B. H. King, Jr., both of Orlando, Fla.

2,464,536. **Cord Processing Apparatus.** R. E. Solliday and J. T. Gordon, assignors to Wingfoot Corp., all of Akron, O.

2,464,592. **Cord Processing Apparatus.** L. S. Hall, Pawtucket, R. I., and R. E. Solliday, assignors to Wingfoot Corp., both of Akron, O.

2,464,638. **Axially Shifting-Type Tire Stripper.** M. V. Falkner, Arlington, Wash.

2,464,658. **Means for Fashioning Articles from Metals or Thermoplastic Materials.** J. Stivin, Celakovice, Czechoslovakia.

2,464,718. **Depolymerizable Material Cutter.** R. L. Potter and F. C. Huber, both of Detroit, Mich.

2,465,482. **Plastic Material Extruder.** T. J. Rhodes, Ramsey, N. J., assignor to United States Rubber Co., New York, N. Y.

2,465,537. **Cable Forming Apparatus.** A. M. Isaacson, Fanwood, and H. H. Merwin, Rutherford, both in N. J., assignors to Western Electric Co., Inc., New York, N. Y.

UNCLASSIFIED

United States

2,462,976. **Hose Clamp.** J. T. King, Burbank, Calif.

2,463,071. **Lever-Actuated Portable Tire Removing Tool.** L. Vanleirsberghe, La Grange Park, Ill.

2,463,226. **Laterally Stabilized Wheel of the Load-Suspension Type.** H. W. Walden, New York, N. Y.

2,463,293. **Hose End.** R. A. Mentel, East Cleveland, O., assignor to Weatherhead Co., Cleveland, O.

2,463,335. **Pneumatic Tire Alarm.** F. M. Warnshuis, Santa Cruz, Calif., and R. T. Lawrence, St. Albans, N. Y.

2,463,605. **Traction Grip Device for Pneumatic Tires.** M. J. Devine, Englewood, N. J.

2,463,634. **Anti-Skidding Device.** E. L. Martinis, Southgate, Ky.

2,464,071. **Tire Transfer Device for Trucks, Etc.** F. W. Coffing, assignor to Coffing Hoist Co., both of Danville, Ill.

2,464,416. **Hose End Assembly.** F. J. Raybould, Lakewood, O., assignor to The Weatherhead Co., Cleveland, O.

2,464,564. **Emergency Traction Device.** T. Dunner, Farmington, and W. Keller, Flint, both in Mich.

2,464,621. **Jack-Type Tire Removing Tool.** L. Vanleirsberghe, La Grange Park, Ill.

2,464,934. **Flat Tire Indicator.** K. B. Kennedy, San Diego, Calif.

2,465,435. **Tire Pressure Indicator.** N. A. Dysart, Mobeetie, Tex., assignor, by mesne assignments, to Tire-Tell Corp., Amarillo, Tex.

2,465,783. **Cable Connector.** D. Beaty, assignor to D. Beaty, 3rd, and R. T. Beaty, all of Warren, Pa.

2,465,972. **Tube Coupling.** J. F. Stephens, Kansas City, Mo., assignor to Guston-Bacon Mfg. Co., a corporation of Mo.

TRADE MARKS

United States

422,129. **Texlite.** Resilient highly compressible material, etc. Sponge Rubber Products Co., Shelton, Conn.

442,157. **Vinylastic.** Vinyl-coated elastic fabrics and webbing. Rodof Textile Co., New York, N. Y.

442,162. **Crysto-Cleer.** Plastic shower caps, raincoats, etc. Boland Mfg. Co., Chicago, Ill.

442,184. **Dixie.** Inner tubes. Robbins Tire & Rubber Co., Inc., Tuscumbia, Ala.

442,192. **Outdoor Wear.** Men's and boys' wearing apparel. Firestone Tire & Rubber Co., also doing business under the name, Firestone Industrial Products Co.,, both of Akron, O.

442,251. **Sno-Flake.** Rubber dressing. Sno-Flake Products Co., Detroit, Mich.

442,281. **B-D.** Syringes and parts thereof. Becton Dickinson & Co., Rutherford, N. J.

442,299. **Air King.** Tires. Ohio Rubber Co., Willoughby, O.

442,320. **Crysto-Cleer.** Shower curtains. Boland Mfg. Co., Chicago, Ill.

442,337. **Ellen Maid.** Foundation garments.

(*Continued on page 260*)

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Silicone News

DC 44 Silicone Grease Ends Bearing Failure in Textile Plant

Bearing failure may burn out your motors, stop your entire production line or ruin a mill run. That's why it's front page industrial news when the Plant Manager of a large textile plant reports that he has not had a single bearing failure since he started to use Dow Corning Silicone Oils and Greases over 30 months ago.

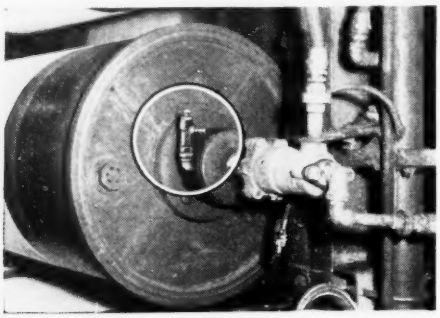

PHOTO COURTESY AMERICAN FINISHING COMPANY

DC 44 Silicone Grease in ball bearings on drying cans, operating at 500 r.p.m. around saturated steam journals, has 45 times the life of the organic grease previously used.

Typical of the lubrication problems that plague plant engineers in textile plants is the maintenance of "steam-heated" bearings. It used to be necessary to lubricate bearings on drying cans and the main cylinder bearings of Sanforizing machines once every 8 hour shift. Since American Finishing started to use DC 44, the re-lubrication schedule has been cut to once every 30 to 45 shifts. The lubrication of Slashers on textile mills presented a similar problem that has also been solved by using DC 44.

On tenter frame chains and races that travel through ovens at 400° F., petroleum oils carbonized so rapidly that the chains had to be cleaned periodically. That costly operation and the need for continuous lubrication have been eliminated by a weekly application of DC 710R Silicone Fluid.

American Finishing, like many other skillfully engineered companies, has found that Dow Corning Silicone lubricants more than pay for themselves in reduced maintenance costs. Increased production due to the virtual elimination of bearing failure is another one of the many bonuses Dow Corning Silicones pay to modern industry. For the most recent data on DC Silicone Greases phone our nearest branch office or write for data sheet No. D5U.

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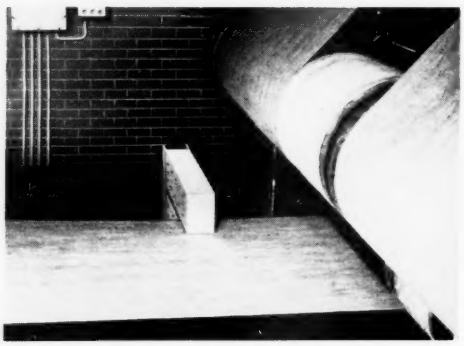


G-E Beta-Ray Thickness Gage Monitoring Resin-Impregnated Paper

Thickness Gage

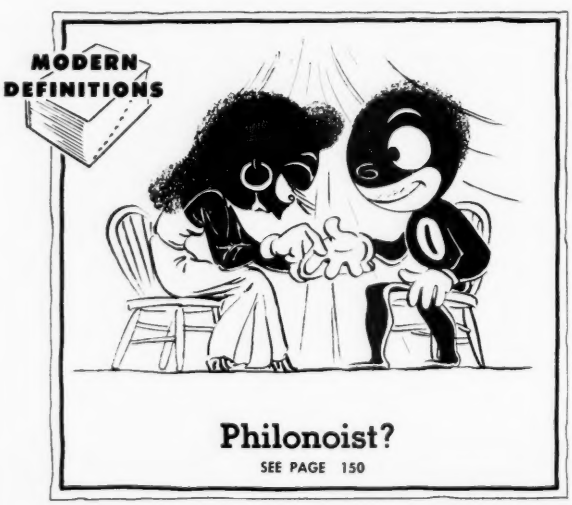
A NEW instrument designed to measure continuously the thickness of sheet materials moving along a conveyer without contacting or disturbing the material has been announced by the special products division, General Electric Co., Schenectady 5, N. Y. Named the Beta-Ray thickness gage, the instrument measures the amount of beta-rays absorbed by the sheet material checked and can be calibrated in terms of material thickness.

Operating on a power supply of 100-125 volts, 60 cycles, the gage has a power consumption of about 150 watts. Accuracy is ±2% or better between normal periods of calibration; while drift is not more than 1% an hour after a 30-minute warm-up period, it is also claimed. Under normal conditions calibration need not be made oftener than once every four hours.

Streamlined Beltmaster

A NEW instrument designed to measure continuously the cutting lengths of belting from stock rolls has been announced by Ralphs-Pugh Co., Inc., 530 Howard St., San Francisco 5, Calif. The new machine operates on the same general principles as the old model, described in our August, 1947, issue, page 601, but is said to be more efficient, easier to handle, and has a motor drive instead of being manually driven.

The new model can handle belts up to 36 inches wide and has



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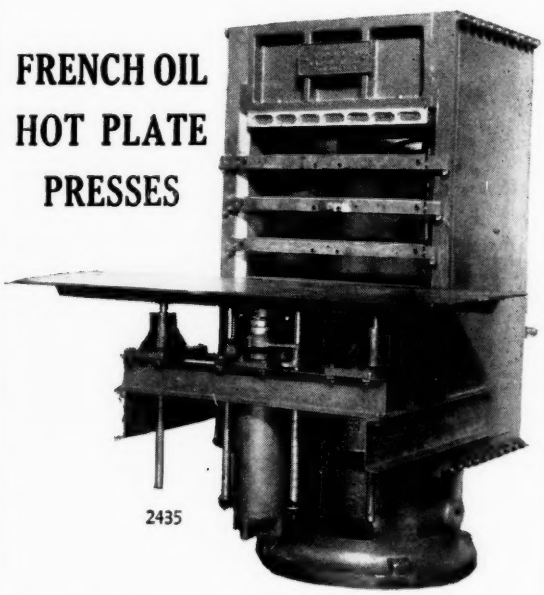

Side plate or column presses for compression or transfer or injection molding of rubber and allied synthetics.

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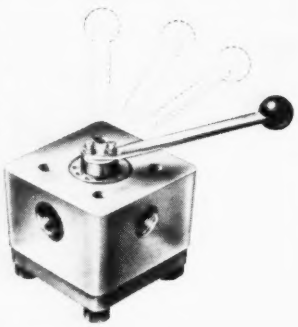

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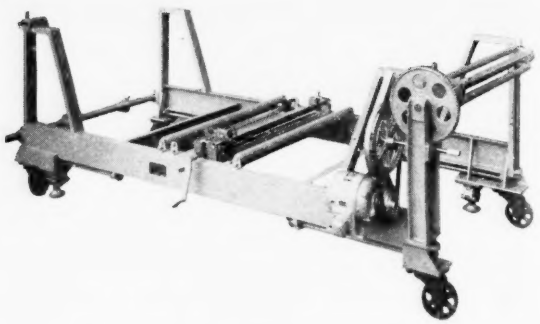
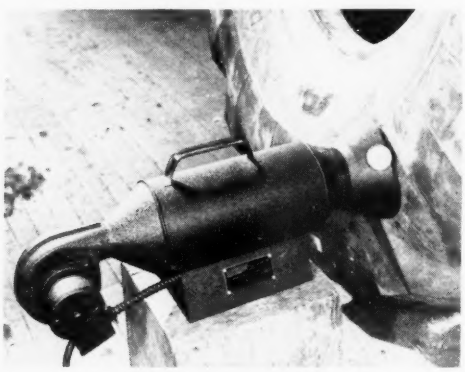


Streamline 1949-1950 Model Beltmaster

a lift capacity of 10,000 pounds. The new unit is also equipped for slitting slabs lengthwise and for raising a heavy belt, such as a conveyer or transmission belt, off the floor for free rolling when it is run through the machine. Instead of the belt having to be pulled through manually as with the old model, it is run up to a certain point and is then pulled through by a roller. When the desired length is run through, it is put on the wind-up core at the power end of the machine and can then be handled easily. Passage of a belt through the machine is a metered operation; cutting by a cross knife is performed automatically when the desired length has been measured. Other features of the new Beltmaster include tension control of the belt, belt guides to insure proper alinement, and a collapsible wind-up roll to permit easy removal from the wound belt.



Air-Weld Vulcanizer for Tire Repair

New Tire Repair Method

A NEW method of repairing injuries to off-the-road tires that penetrate only a few of the tire's plies is recommended by Goodyear Tire & Rubber Co., Akron, O., as a means of effecting savings in maintenance costs. By means of the process, injuries not extending too deeply into the tire may be repaired quickly and easily, without removing the tire from the vehicle.

Repairs are accomplished with the Schlegel Air-Welder, made by R. E. Schlegel, Inc., Akron. This unit is a light, portable, electrically operated hot-air blower or vulcanizer that vulcanizes a special rubber into the injury without physical pressure. The vulcanizer weighs 17 pounds and may be used wherever electric current is available. The special rubber used, named Air-Weld rubber, is made exclusively for Schlegel by Goodyear.

The procedure for making spot repairs with the Air-Welder is the same as that used with a hot plate or vulcanizer in the cementing operation. The tire's injury cavity is filled with rubber to the outer surface of the tire. The Air-Welder with blower cone is placed over the repair area; the edges of the cone are ¼- to ½-inch from the tire to allow hot air to circulate. After the repair rubber becomes warm and soft, it is rolled down, and the Air-Welder replaced over the repair during the remainder of the cure. Curing time is normally from one hour to three hours, depending on the depth of repair. The complete Schlegel unit includes the Air-Welder, ¼-inch electric drill with adapter and one rasp. Air-Weld rubber available in 10-pound rolls, and Air-Weld cement sold in one-gallon cans.

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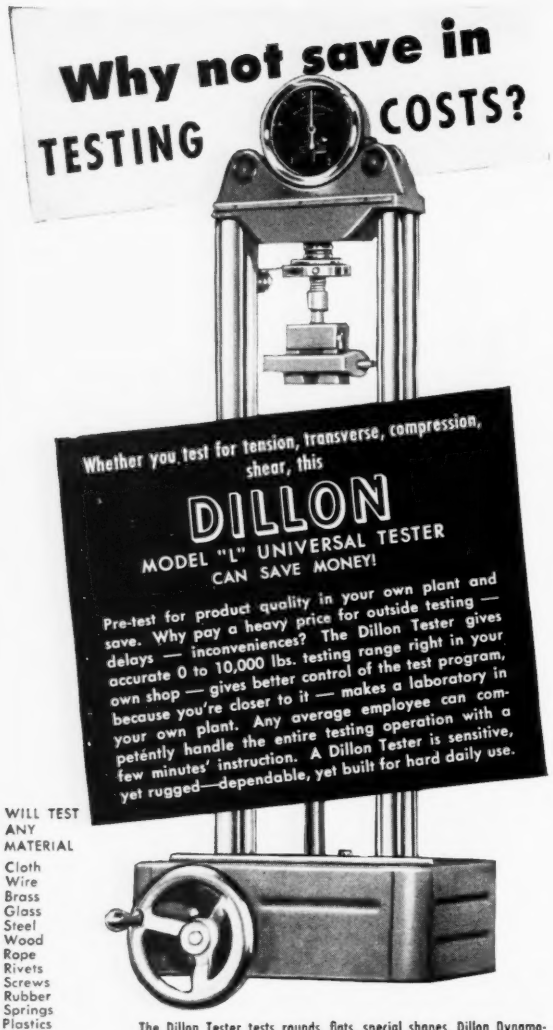
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GERMANY

Trends in the Rubber Industry

In a recent issue of *Kautschuk und Gummi*,[1] the trends in the rubber industry in 1948 are reviewed, and it is shown that the currency reforms introduced in both the Eastern and Western zones during the year have served only to drive the two still farther apart economically as well as politically. Whereas the Western zones have been encouraging a certain amount of free enterprise, the opposite policy has been followed in the East where a process of accelerated nationalization is squeezing private enterprise ever more into the background, with government control now expressing itself firmly in the new two-year plan for the zone.

In the rubber and asbestos industry 16 factories, employing about 6,000 persons and producing in the first half of 1948 goods valued at 30,780,000 Reichsmarks, were reportedly expropriated and combined in the Association of Nationalized Factories "Kautschuk und Asbest," with headquarters in Leipzig. Under this arrangement production in the second half of 1948 was said to have exceeded quota, but actual figures are not available. Admittedly the planned output of tires, which has a prominent place in the two-year plan, was hampered by shortages of machinery in individual factories, necessitating steps to make up the lack. The earlier shortages of carbon black and necessary chemicals, however, were stated to have been considerably relieved after the former Nitrogen Works at Piesteritz started producing carbon black and the former Wolfen works of I. G. Farbenindustrie also took up the manufacture of accelerators.

In the Western sector the currency reforms and the more liberal export policy have considerably stimulated the manufacturing industries. But this attitude has not proved to be an unmixed blessing, at least in regard to the asbestos and rubber industries where production was increased to such an extent that toward the end of the year serious shortages of some essential raw materials threatened to develop.

The raw material situation in this sector at the end of 1948 and for 1949 was discussed at the first meeting of the recently formed Industrial Society of the German Rubber Industry. In December, 1948, only 4,534 tons of natural rubber had been available, it was shown; and the allotment of $17,000,000 for rubber for the first six months of 1949 would probably cover 35,000 tons, or roughly 5,900 tons a month, which, it was pointed out, was an amount hardly permitting a further increase in production of mechanical rubber goods; while the allotment of $500,000 for synthetic rubber in the first quarter of 1949 would not permit the purchase of more than about 1,100 tons. Supplies of reclaim were satisfactory, with December consumption at 1,550 tons, against output for the month of 1,973 tons; the situation in carbon black and chemicals had improved considerably, but the worst problem confronting the industry was still the lack of textiles.

As to future developments, under the Marshall Plan 78,000 tons of rubber would be available for the period July, 1949, to June 30, 1950, working out at 6,500 tons monthly, of which 4,500 tons would go into tires and the balance into general rubber goods. The export goal it was added, was set at $10,000,000 for the 1949-50 period and at $15,000,000 for 1950-51. In the first half of 1948 the raw rubber imports represented 83% (by quantity) of those for 1936, but exports of rubber goods were only 9% of the 1936 quantity.

[1] Jan., 1949, p. 3.

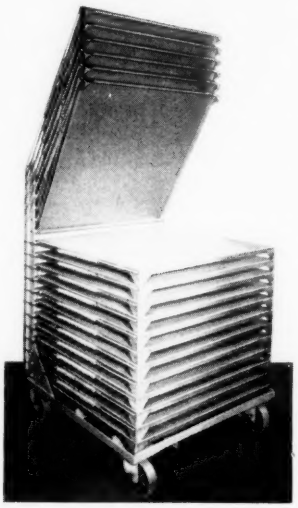
German Industry Notes

Eckert & Ziegler G.m.b.H., Weissenberg, Bavaria, which has been specializing in the manufacture of injection molding machines and molds for thermoplastic materials for a number of years, has resumed construction of two types of injection molding machines: one, hand-operated, produces parts weighing up to eight grams each; while the other, a hydraulic machine, makes parts up to 50 grams each. In the current year, production will be started on a larger machine capable of putting out parts weighing 120 grams each.

Dynamik A.G., formerly Alfred Nobel & Co., Troisdorf, has again increased output of its plastics division. It is estimated that in 1948 between 8,000 and 9,000 tons of plastics were produced.

The Pfalzische Gummiwerke G.m.b.H., Frankenthal, French

New Stock Cooling Rack



This new Rack gives unobstructed access to three sides of each tray and offers a convenient method for storing materials that require cooling or air drying. The one piece construction Trays are spring supported and can be quickly raised or lowered, free from all locking devices. Racks having 18 perforated trays 36″ x 36″ or plain surface trays 36″ deep by 4 ft., 6 ft. and 8 ft. long, can be furnished either stationary or mounted on casters.

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59 plants located in 27 states give Eagle-Picher's activities a national scope. Strategic location of plants and extensive production facilities enable Eagle-Picher to serve industry with increased efficiency... we manufacture a comprehensive line of both lead and zinc pigments for the rubber, paint and other process industries.

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In this small space we cannot adequately describe this remarkable valve. Briefly, the body is made entirely of the strongest forged steel. All of the internal metal parts are of hard chromium plated stainless steel. A formed packing of special material superior to leather is used which is immune to all fluids commonly used in hydraulic machinery. The pressure on the seat is balanced by a piston with the result that variations in high initial pressure have little effect on the reduced pressure. And so on. If interested, ask for complete information.

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- **ECONOMY**—more bulk without increased weight.
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Zone, was founded about two years ago and includes several branch factories. It produces soling material, camelback, packing, hose of all kinds, and household articles. Tire production on a large scale is also contemplated. The company recently demonstrated a new all-purpose calender having an effective width of 1.20 meters; another with effective width of 1.80 meters is about to be set up.

In view of the policy of the authorities to ease export restrictions, the Society has formed an Export Committee for the Rubber Industry, including the following firms: Continental Gummiwerke A.G., Hannover; Harburger Gummiwaren-Fabrik Phoenix A.G., Hamburg-Harburg; Hanauer Gummischulifabrik A.G., Hanau/Main; Hessische Gummiwarenfabrik Fritz Peter A.G., Klein-Auheim; Koln. Gummiffadenfabrik vorm. Ferd. Kohlstadt & Co., Cologne; New York-Hamburger Gummiwaren-Co., Hamburg; Metzeler Gummiwerke A.G., Munich; Pahl'sche Gummi-u. Asbest-Gesselschaft Paguag, Dusseldorf-Rath; Radium Gummiwerke m.b.H., Koln-Delbruck; and two representatives of the export trade. The selection of these firms was determined by their prewar experience in the export field.

SWEDEN

In 1948, Sweden imported 14,610 tons of unworked rubber, against 15,756 tons in 1947, in addition to 1,433 tons of ebonite dust and rubber waste, against 701 tons in the preceding year. Imports of rubber manufactures included 84 tons of soles and heels, against 176 tons; 1,281 tons of hose and tubing, against 1,136 tons; 1,035 tons of belting, against 1,271 tons; cycle tires, 553, against 144 tons; automobile tires and tubes, 4,663 against 8,843 tons; other rubber goods, including surgical rubber, 131 against 393 tons; rubber footwear, 501 against 834 tons; and rubber-soled footwear, 129 against 258 tons. It will be noted that the increases in certain materials and manufactures did not make up for the general decline in imports; the sharp drop in purchases of automobile tires and tubes, amounting to almost 50%, is especially striking.

Rubber exports continued on a very modest scale in 1948, but tended to increase; the most important article of export as usual was rubber footwear, which rose to 213 tons from 173 tons in 1947. There were also shipped out 21 tons of rubber-soled footwear, against 13 tons; 19 tons packing, heels, soles, against 17 tons; and 13 tons of tires for automobiles and motorcycles, against four tons.

Under a Swedish-Hungarian trade agreement running from October, 1948, to September, 1949, Sweden is to supply various kinds of chemical products including polyvinyl chloride to a value of 450,000 crowns; liquid resin glue and other unspecified chemicals totaling 350,000 crowns. Hungary's deliveries to Sweden will include miscellaneous chemical products valued at 500,000 crowns.

The Swedish Wood Research Institute has asked the government to allow 3,750,000 crowns to finance a six-year program of research on the chemical utilization of waste products of the cellulose and lumber industries.

GREAT BRITAIN

C. Falconer Flint has been appointed head of the National College of Rubber Technology. A well-known authority on latex and latex technology, he is the author of the first British textbook on the chemistry and technology of rubber latex and of numerous papers on the subject. Dr. Falconer Flint had been on the staff of the Rubber Research Institute of Malaya and, since 1934, on the staff of the rubber service department of Imperial Chemical Industries, Ltd.; he was assistant manager of the department when he resigned to take up his new appointment.

Representatives of various trade organizations, including the Federation of British Manufacturers' Associations, recently appealed to the Chancellor of the Exchequer to remove the duty of 9d. a gallon on light oils not used for road purposes. For the rubber industry it was stated that light hydrocarbon oils were used extensively in that industry and for rubber solutions for use in other industries and that owing to the present difficulty in obtaining solvent recovery apparatus a large proportion of the solvent used was lost. The point was made that before the war the greater part of the rubber goods output went into the home trade, but now most of it was intended for export, and the duty prevented attainment of highest possible export targets.

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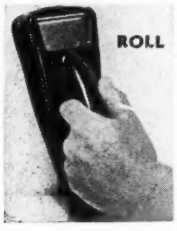

The roll model is for checking surface temperatures of still or moving rolls; the mold type for checking surface temperatures of mold cavities; the needle type for "within-the-mass."

CAMBRIDGE
ROLL — NEEDLE — MOLD
PYROMETERS

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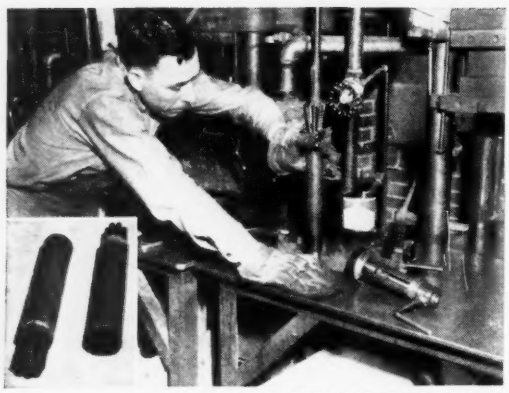

PHOTO COURTESY MURRAY RUBBER COMPANY

DC Mold Release Emulsion No. 35 permits easy release of Neoprene electric cable boots used in oil well surveying equipment.

Rapid flow of stock is imperative in molding the electric cable boots shown above. The cavity between the long mold core and shell is less than $\frac{1}{4}$-inch wide and there are 9 thin walled collars to be filled. Easy release of these complicated moldings is equally important. Each part must be perfect in every detail to pass inspection. But DC Mold Release Emulsion No. 35 makes this precision molding a relatively simple operation.

Production engineers at Murray Rubber Company of Houston, Texas, have learned by experience that DC Mold Release Emulsion No. 35 improves flow and gives easy release from even the most complicated molds. In this particular application, a dilute solution containing only 1 or 2 parts of Emulsion No. 35 to 100 parts of water is brushed on the mold cores to give easy release, to reduce scrap and to cut mold costs.

Like most of the leading tire and rubber companies, Murray Rubber has standardized on DC Mold Release Emulsion No. 35. This Dow Corning Silicone mold release agent readily wets metals to form a heat-stable silicone surface that improves the flow of hot rubber, imparts a high surface finish and practically eliminates non-knits and foldovers. DC Mold Release Emulsion No. 35 does not break down to form a carbonaceous deposit on the mold. Hence, molds stay clean 5 to 20 times as long and mold maintenance is greatly reduced.

DC Mold Release Emulsion No. 35 can be brushed, sprayed or wiped on molds to give easy release to a variety of rubber products including mechanical goods, tires, soles and heels, floor tile and toys. It's economical to use and easy to apply.

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Sematic is a new type of tiled flooring produced by Semtex, Ltd., from fibrous mineral fillers bonded with synthetic resin and colored with non-fading pigments. The material is calendered into sheets $\frac{1}{8}$- or 3/16-inch thick and cut into tiles nine inches square. Flooring of this type has been used on board the *Wellington*, headquarters of the Honorable Company of Master Mariners, lying in the Thames. Here the tiles were superimposed on special latex-based cork-filled underlay $\frac{1}{8}$-inch thick, laid directly to steel or concrete bases. Sematic tiles, claimed to be designed to give maximum resistance to wear at a cost below that of the best grades of linoleum, are available in 15 different plain and marbled colors. This flooring has already been used in schools, churches, offices, and apartments, as well as on ships, with reportedly very good results.

Petrochemicals, Ltd., has started the first cracking furnace at its plant to produce chemicals from petroleum at Partington. The cracking furnaces transform the charging stock—a petroleum distillate—into liquids and gases, which are processed in subsequent plants to yield finished chemicals. The company, which has a £4,500,000 plant, employs the Catarole process, a British invention which permits the production of more than 70 different chemicals from the liquids and gases derived from petroleum, among which are raw materials for paints and varnishes, rubber and plastics products, dyestuffs, detergents, drugs, anaesthetics, pharmaceuticals, and special fuels. Hitherto many of these chemical raw materials have either been imported from dollar areas or produced, it is claimed, by less economic or less productive methods. A number of these chemicals have never been available in Britain in bulk before.

FINLAND

The Suomen Gummitehdas Osakeiihtio, Nokia, Finland's largest rubber manufacturing concern, celebrated its fiftieth anniversary last year. The company got its start in Helsinki, when it made mainly galoshes and other types of rubber footwear. In 1904 manufacturing was moved to Nokia when a more up-to-date factory was installed, which was further modernized and extended after the first World War. Production then also included heels and soles, belting, hose, tires and tubes for automobiles and cycles, and various mechanical rubber goods.

The manufacture of mechanicals was transferred to Savio in the 1930's, following the absorption in 1932 of a rubber company which had been operating in Savio since 1925. The existing plant was extended to include new products as rubber flooring, covers for rolls, and raincoats. Meanwhile the factory at Nokia was being constantly improved and enlarged; the latest addition was a tire factory completed in 1946 and expected eventually to be able to cover the tire and tube needs of the whole country.

The Suomen concern provides for its employes housing, sick relief, special relief and pensions, and trade schools for the younger generation.

Managing director of the company is Torsten Westerlung, who has held this position since 1930; technical manager is E. H. Liljeroos, and chairman of the board, Gust. Komppa.

Philonoist?

SEE PAGE 150

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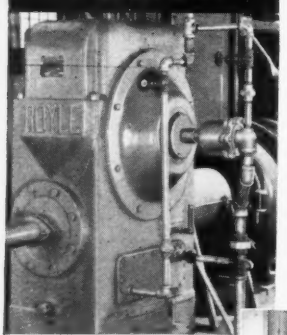
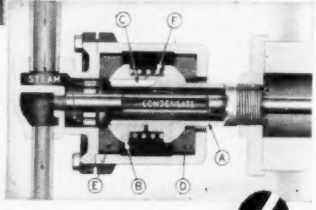


Johnson Joint installed on rubber extruder. Photo courtesy of Manhattan Rubber Div., Raybestos-Manhattan, Inc.



Rotating member consists of Nipple (A) and Collar (B), keyed together (C). Seal ring (D) and bearing ring (E) are of self-lubricating carbon graphite. Spring (F) is for initial seating only; joint is pressure sealed in operation.

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Editor's Book Table

BOOK REVIEWS

"High-Polymer Physics—A Symposium." Edited by Howard A. Robinson. Remsen Press Division, Chemical Publishing Co., Inc., 26 Court St., Brooklyn 2, N. Y. Cloth, 5½ by 8½ inches, 584 pages. Price $12.

Published under the auspices of the American Institute of Physics, this book contains 23 papers originally presented before the High-Polymer Division, American Physical Society, in a symposium held in New York, N. Y., in January, 1946. The papers are grouped in four sections. Part I, entitled "Determination of the Molecular Structure of High Polymers," comprises three papers: "The Use of Color and Fluorescence Indicators for Determining the Structure of Glasses," W. A. Weyl; "Applications of Infra-Red Methods in the Structural Examination of Synthetic Rubber," J. E. Field, D. E. Woodford, and S. D. Gehman; and "An X-Ray Diffraction Investigation of Some Polygalacturonides," K. J. Palmer.

The second part, "The Physical Properties of High Polymers," consists of 12 papers: "The Mechanical Properties of Textiles (The Simple Non-Newtonian Model)," Henry Eyring and George Halsey; "The Elastic Properties of Cork," S. L. Dart and Eugene Guth; "Significance of the Equation of State for Rubber," Eugene Guth, P. E. Wack, and R. L. Anthony; "Viscometric Investigation of Dimethylsiloxane Polymers," A. J. Barry; "The Formation of Ionized Water Films on Dielectrics under Conditions of High Humidity," R. F. Field; "The Effect of Time on Thermal Expansion and Second-Order Transition Points in High Polymers," R. S. Spencer and R. F. Boyer; "A New Approach to the Theory of Relaxing Polymeric Media," M. S. Green and A. V. Tobolsky; "The Theory of Permanent Set at Elevated Temperatures in Natural and Synthetic Rubber Vulcanizates," R. D. Andrews, A. V. Tobolsky, and E. E. Hanson; "Stress-Time-Temperature Relations in Polysulfide Rubbers," M. D. Stern and A. V. Tobolsky; "Crystallization of Unvulcanized Rubber at Different Temperatures," L. A. Wood and Norman Bekkedahl; "Tackiness of GR-S and Other Elastomers," W. F. Busse, J. M. Lambert, and R. B. Verdery; and "Electrostatic Properties of Rubber and GR-S," R. S. Havenhill, J. C. O'Brien, and J. J. Rankin.

Part III, "The Chemical Physics of High Polymers," contains five papers: "Application of the Methods of Molecular Distribution to Solutions of Large Molecules," B. H. Zimm; "Remarks on the Viscosity of Dilute Solutions of Polymers and Related Phenomena," Robert Simha; "Thermal Polymerization of Drying Oils," H. E. Adams and P. O. Powers; "Determination of Polymer-Liquid Interaction by Swelling Measurements," Paul Doty and H. S. Zable; and "Some Thermodynamic Properties of Slightly Cross-Linked Styrene-Divinyl Benzene Gels," R. F. Boyer and R. S. Spencer.

The concluding section, "Instrumentation and High Polymers," consists of three papers: "Thermal Diffusion of Polymer Solutions," P. Debye and A. M. Bueche; "A Photoelectric Instrument for Light Scattering Measurements and a Differential Refractometer," P. P. Debye; "An Attachment for Determining the Angular Distribution of Scattered Light in a 90-Degree Turbidimeter," J. N. Wilson.

Comprehensive author and subject indices are appended.

"Commodity Exchanges and Futures Trading." Julius B. Baer and Olin Glenn Saxon. Harper & Brothers, 49 E. 33rd St., New York 16, N. Y. Cloth, 6 by 9 inches, 334 pages. Price $5.

The only book on this subject, this volume gives a detailed and authoritative study and analysis of commodity exchange operations in every phase of theory and practice. An elaborate and modernization of a previous book, "Commodity Exchanges," published in 1929, this volume gives a presentation of the subject matter that is complete in every respect. Rubber trading, both in the physical and futures markets, is taken up in great detail, and the book will prove indispensable to all interested in this phase of the rubber industry.

The scope of the book can be showed by its chapter headings: historical development of commodity exchanges; the economic functions of commodity exchanges; speculation—a constructive economic activity on commodity exchanges; grading, standardization, and inspection; publicity of prices, crop and market reports, and other statistics; commodities adaptable to futures trading; the futures or exchange contract; organization and operation of a commodity exchange; the clearing house and its relation to the exchange; a typical transaction on the exchange; hedging; hedging in practice; the Commodity Exchange Act; the law of

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commodity exchanges—relations with the state, relations with members; the legality of clearing house operations; and the exchange and third parties. A table of legal cases is appended together with a bibliography and subject index.

NEW PUBLICATIONS

"Azo Zinc Oxides for Every Purpose." American Zinc Sales Co., P. O. Box 327, Columbus 16, O. 24 pages. This booklet presents chemical and application data on each of the company's zinc oxides. Other sections include photomicrographs of zinc oxide particles, discussions of the uses of Azo zinc oxides in various industries, and a table of bulking values.

Publications of E. I. du Pont de Nemours & Co., Inc., Wilmington 98, Del. **"The Neoprene Notebook."** No. 42, February, 1949. 12 pages. This issue of the "Notebook" contains stories on neoprene adhesives, V-belts, coupling device for oil pipe lines, coated fabric gloves, gaskets for oil well lubricators, deck coverings for ocean vessels, and case histories of hose applications. **"The Neoprene Notebook Index."** 4 pages. This is a comprehensive subject index covering the first 42 issues of the "Notebook."

"Sindar Reporter." No. 1, 1949. Sindar Corp., 330 W. 42nd St., New York 18, N. Y. 4 pages. This edition of the company publication is devoted to "Odorless Rubber, Industry's Answer to a Buyers' Market." A complete discussion is given on the value of aromatic materials, such as the company's Paradors, in rubber products, including baby items, beachwear, rainwear, footwear, and household goods.

"Introducing Witco Sunolite." Technical Service Report R-7. Witco Chemical Co., 295 Madison Ave., New York 17, N. Y. 8 pages. This report describes Witco Sunolite, a waxy material used to inhibit static atmospheric and corona cracking of rubber. Information on the physical properties and compounding characteristics of the material appears, together with extensive laboratory test data and formulations on its use in smoked sheet, GR-S, and Hycar OR-15 compounds.

"Baldwin Emery Hydraulic Cells." Bulletin No. 288. The Baldwin Locomotive Works, Philadelphia 42, Pa. 8 pages. This bulletin describes and illustrates six standard-model Emery hydraulic cells for general industrial weighing and special laboratory testing equipment. Several special weighing units are also described, together with information on the principles of the Emery cell and Tate-Emery recorder.

"Upholstering with Firestone Velón Flex." Firestone Plastics Co., Pottstown, Pa. 4 pages. Designed for furniture and equipment producers, this booklet covers methods of application of Velón Flex upholstery. The features and advantages of the material are described, and details given on techniques of making patterns, cutting, stitching, tacking and nailing, furniture frame treatment, trimming, storing, and cleaning.

"Pliolite S-5 Made by Goodyear." Goodyear Tire & Rubber Co., Akron, O. 36 pages. This illustrated booklet offers a brief history of Pliolite S-5 and its manufacture as well as information on general properties; compounding, including solvents, modifiers, and pigmentation; applications; and data on behavior of finished coatings in weathering and chemical tests.

"The State of the Company. Volume Two." Timken Roller Bearing Co., Canton, O. 233 pages. **"Commercial Chemical Development."** R. S. Aries & Associates, 26 Court St., Brooklyn 2, N. Y. 6 pages. **"List of Inspected Fire Protection Equipment and Materials. January, 1949."** 200 pages. **"Bi-Monthly Supplement to All Lists of Inspected Appliances, Equipment, Materials. February, 1949."** 78 pages. Underwriters' Laboratories, Inc., 207 E. Ohio St., Chicago 11, Ill. **"The Human Race. The Travelers 1949 Book of Street and Highway Accident Data."** The Travelers Insurance Cos., Hartford, Conn. 30 pages.

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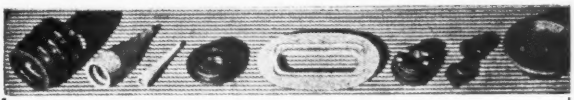

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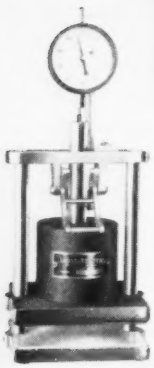

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(Classified Advertisements Continued on Page 257)

Market Reviews

CRUDE RUBBER

Commodity Exchange

WEEK-END CLOSING PRICES

	Feb. 26	Mar. 26	Apr. 2	Apr. 9	Apr. 16	Apr. 23
Futures:						
No. 1 Contract:						
June	18.13	18.00	18.74	18.52	18.25	18.30
Aug.	17.92	18.41	18.50	18.33	18.02	18.07
Oct.	17.80	18.26	18.31	18.14	17.80	17.85
Dec.	17.70	18.10	18.00	17.90	17.58	17.65
Feb.	17.60	18.00	18.05	17.73	17.41	17.48
Apr.	17.50	17.90	17.95	17.60	17.28	17.35
Weekly Sales, Tons:						
No. 1 Contract	2,730	1,700	2,690	4,590	1,680	1,050
Std. Contract	20	0	0	0	0	0
Total	2,750	1,700	2,690	4,590	1,680	1,050

RUBBER futures trading during April on the Commodity Exchange could only be described as dull. Some activity occurred during the first week, but this consisted of trade and commission house switching from their May holdings into the distant months. After this short flurry the market lapsed into dullness owing to the absence of any factory demand. The prospect of a world natural rubber surplus of 125,000 tons this year, as compared with 107,000 tons in 1948, continued to hang over the market, although this surplus was below previous expectations.

Prices were nervous early in the month and then eased off as dealers awaited some change in the market. May futures began at 18.87¢ on April 1, the high for the month, fell to hover in the 18.30-18.40¢ range during the balance of the month, and closed at 18.35¢ on April 29 after April futures went off the board. July futures began the month at 18.60¢, fluctuated around 18.20¢ for the next few weeks, and closed at 18.18¢ on April 29.

The inactivity of the market was reflected by the low number of sales. There were no sales in the standard contract, now confined only to April and May, while the newer No. 1 contract showed a total of 12,440 tons sold. This total was well below the relatively low figure of 13,740 tons sold in March, and two-thirds of the sales took place during the first and last weeks when switching operations predominated.

New York Outside Market

WEEK-END CLOSING PRICES

	Feb. 26	Mar. 26	Apr. 2	Apr. 9	Apr. 16	Apr. 23
Futures						
No. 1 R.S.S.:						
Apr.-June	18.25	18.75	18.75	18.63	18.25	18.38
July-Sept.	18.13	18.63	18.63	18.50	18.13	18.13
Oct.-Dec.	18.00	18.50	18.50	18.25	18.00	18.00
No. 3 R.S.S.	17.38	17.25	17.25	17.25	16.88	16.75
No. 2 Brown	15.25	15.25	15.25	15.50	15.13	15.00
Flat Bark	12.25	12.13	12.38	12.25	12.13	12.13

RUBBER trading on the New York Outside Market was entirely listless last month. Large-scale factory demand was noticeable by its absence, and the few flurries of activity that took place were short-lived and only moderate in volume. Rather than maintain inventories, rubber companies are said to be consuming their stocks of crude, most of which were acquired last year.

Factory reluctance to purchase new rubber even at current low prices stems directly from lagging tire sales. Instead of the usual seasonal increase in tire demand, with increasing output, tire companies have continued to operate at reduced schedules. Despite this reduced production, inventories have continued to mount, and prospects of passing these inventory tires to dealers and retailers is slight since retailers' inventories have been near the maximum since late in 1948. In keeping with tire company beliefs that tire sales would remain at nigh levels this year, there were reports late in April that sales were showing some improvement, and dealers looked forward to resumed crude rubber purchasing within the next few months to replace depleted stocks.

The spot price for No. 1 R.S.S. began at the monthly high of 18.75¢ on April 1, fluctuated irregularly during the first week of trading, then declined and remained in the 18.25-18.38¢ range during the balance of the month, closing at 18.38¢ on April 29. After opening at 17.25¢ on April 1, the price for No. 3 R.S.S. declined and fluctuated between 16.75¢ and 17.00¢. No. 2 Brown ranged between 15.00¢ and 15.50¢ during the month; while Flat Bark sold at 12.13-12.38¢ during April.

Latices

DOMESTIC consumption of all types of rubber latices during 1948 was more than 54,000 long tons, dry weight, a substantial advance over the 43,000 tons consumed in 1947. Estimates for 1949 and 1950 continue the increases, according to Arthur Nolan, Latex Distributors, Inc., writing in Lockwood's April *Rubber Report*. Imports of *Hevea* latex by other countries during 1948 totaled more than 20,000 tons, an increase of 80% over the 1937-1941 yearly average. The United States absorbed about 62% of available *Hevea* latex during 1948 and consumed about 55%. Including synthetic rubber latices, the United States absorbed more than 70% of all latices produced during 1948 and consumed about 68%.

Mr. Nolan gives final January domestic *Hevea* latex figures as follows: imports, 1,132 long tons, dry weight; consumption, 2,526 long tons; and month-end stocks, 10,027 long tons. Preliminary figures for February are: imports, 2,159 long tons; consumption, 2,750 long tons; and month-end stocks, 9,854 long tons. February receipts of *Hevea* latex were lower than consumption by 591 tons, continuing the trend to reduce top-heavy stocks. February production of GR-S latex is given as 1,459 long tons, an increase of 102 tons over January output, and production is estimated at 1,679 tons for March. Prices for both *Hevea* and GR-S latices remain unchanged; *Hevea* bulk prices are 20-28.5¢ a pound, and GR-S bulk prices are 18.5-20.25¢ a pound.

RECLAIMED RUBBER

SALES of reclaimed rubber showed a decided decline during April, being approximately 30% below the March level. This reduction reflected the inactivity of the rubber industry in general and was also caused by the competition arising from current low crude rubber prices. Observers believe the industry has struck bottom and expect reclaim to improve during May.

Final January and preliminary February statistics on the domestic reclaimed rubber industry are now available. In January, production totaled 19,741 long tons; consumption, 19,031 long tons; exports, 991 long tons; and month-end stocks, 32,868 long tons. Preliminary figures for February give a production of 18,243 long tons; consumption, 17,636 long tons; and month-end stocks, 32,862 long tons. Estimates on February exports are not available.

There were no changes in reclaimed rubber prices during April; current prices are:

Reclaimed Rubber Prices

	Sp. Gr.	¢ per Lb.
Whole tire	1.18-1.20	8.5 / 9
Peel	1.18-1.20	8.5 / 9.5
Inner tube		
Black	1.20-1.22	12.75/13.75
Red	1.20-1.22	14 /14.5
GR-S	1.18-1.20	9.5 /10
Butyl	1.16-1.18	8.5 / 9
Shoe	1.50-1.52	8.25/ 8.75

The above list includes those items or classes only that determine the price basis of all derivative reclaim grades. Every manufacturer produces a variety of special reclaims in each general group separately featuring characteristic properties of quality, workability, and gravity at special prices.

SCRAP RUBBER

LITTLE activity was noted in the scrap rubber market during April, although dealers indicated that some supplies were moving and demand for red tubes continued good. Export business slowed down somewhat during the month. Bizonia took no scrap rubber from the United States during April, although purchases amounting to about $800,000 were made from the sterling bloc countries, Netherland, Belgium, and Luxembourg. Reports from Tokyo stated that awards had been made for the 5,000 tons of scrap rubber purchased in March.

Bill No. 2024 in the New York State Assembly, which provided for the branding of recapped tires and the bead cutting of all tires sold to scrap dealers, has been shelved and put over for the Assembly's next session. The scrap rubber trade had been greatly disturbed by this bill, and many protests had been filed with the Assemblymen. It was pointed out in discussions by the Scrap Rubber Institute that this bill could well serve as a guide for similar measures in other states and result in a real threat to the scrap rubber industry.

The problem of freight rates was also discussed by the Institute at the recent convention of the National Association of Waste Material Dealers. In an effort to forestall attempts by the railroads to reclassify waste materials into a higher freight group, the Association's traffic committee filed a protest with the Committee on Uniform Classification in Washington.

No changes were made in scrap rubber prices during April, and following are dealers' selling prices for scrap rubber, in carload lots, delivered to mills at points indicated:

	Eastern Points	Akron, O.
	(Per Net Ton)	
Mixed auto tires	$12.50	$13.50
Peelings, No. 1	55.00	55.00
" 2	33.00	33.00
	(¢ per Lb.)	
Black inner tubes	4.50	5.00
Red passenger tubes	7.50	7.50

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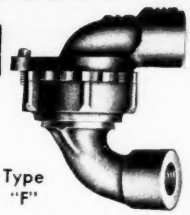

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COTTON AND FABRICS

New York Cotton Exchange
Week-End Closing Prices

Futures	Feb. 26	Mar. 26	Apr. 2	Apr. 9	Apr. 16	Apr. 23
July	31.08	31.13	31.23	31.48	32.11	32.41
Oct.	28.16	28.30	28.79	28.84	29.07	28.97
Dec.	27.93	28.07	28.55	28.56	28.81	28.76
Mar.	27.83	27.91	28.39	28.43	28.68	28.64
May	27.60	27.67	28.00	28.19	28.47	28.44
July	26.97	26.73	27.00	27.24	27.45	27.49

COTTON prices moved very slightly higher on the New York Cotton Exchange on the basis of active short covering and expectations of increased export demand. Distant months were bolstered by the wide price premiums prevailing between old crop (May and July) and new crop months. Some observers believe that potential exports, mostly ECA and Japanese use of the revolving fund, and the expected high loan level for cotton will bring even higher prices. This view was expressed despite moderate domestic consumption, prospects of a high cotton carryover, and indications of another large crop on its way. Most of the fear of a large cotton surplus this year has been mitigated by the knowledge that the greater portion of it will be in loan and for the most part off the free market.

Other market sources feel that once the May covering is ended, the true cotton supply picture, balanced against expected demand, will cause at least a temporary market decline since traders are believed likely to delay buying until the 1949-1950 crop is available. It is also thought that most ECA purchases will not be made until the cheaper new crop appears. Japan was expected to get 60,000 bales of cotton during April and a like amount each month for the next few months.

The United States Bureau of the Census reported that cotton consumed in March totaled 720,892 bales of lint and 134,063 bales of linters, compared with 640,182 bales of lint and 119,007 bales of linters consumed in February.

As for actual price movements on the Exchange, the 15/16-inch middling spot price was 33.54¢ on April 1, rose irregularly to a high of 34.31¢ on April 25, and closed the month at 33.65¢. July futures showed corresponding motion, starting the month at 31.18¢, reaching a high of 32.58¢ on April 25, and closing at 32.45¢ on April 30.

Fabrics

The cotton fabrics market showed a slight improvement in tone last month as demand picked up moderately. There was a revival of activity in the coating trade, and sateens moved briskly for April and May delivery. Headlinings continued a steady business, with the automobile trade taking in most of the goods in May contracts. Although some May sales were made, the tire industry was reported to be taking only a very moderate amount of chafer fabrics and to be continuing its hand-to-mouth purchasing policy. After a rather protracted period of dullness, some interest developed in osnaburgs late in the month, with demand centered in the 40-inch 40x26 2.11-yd. and 32x26 3.65-yd. constructions.

Wide drills sold in May in most constructions; while hose and belting ducks moved slowly and were still available for April delivery. Wide and numbered ducks continued to be quoted at 45% off list price. Activity was shown in bombazine and print cloth raincoat fabrics after a price reduction of approximately 1¢ a yard.

Current prices for cotton fabrics are listed below:

Cotton Fabrics

Drills		
59-inch 1.85-yd.	yd.	$0.375
2.25-yd.		.33
Ducks		
38-inch 1.84-yd. S. F.	yd.	.425
2.00-yd. D. F.		.31/.315
51.5-inch 1.35-yd. S. F.		.52
66-inch 1.02-yd.		.73
Hose and belting		.64
Osnaburgs		
40-inch 3.65-yd.	yd.	.1425
Raincoat Fabrics		
Bombazine, 64 x 60 5.35-yd.	yd.	.215
Print cloth, 38½-inch, 64 x 60		.1375
Sheeting, 48-inch, 4.17-yd.		.23
52-inch 3.85-yd.		.2488
57-inch 3.47-yd.		.2763
60-inch 3.30-yd.		.2913
Chafer Fabrics		
14-oz./sq. yd. Pl.	lb.	.70
11-65-oz./sq. yd. S		.64
10-80-oz./sq. yd. S.		.66
8.9-oz./sq. yd. S.		.69
14-oz./sq. yd. S.		.63
Other Fabrics		
Headlining, 59-inch 1.35-yd, 2-ply	yd.	.565
64-inch 1.25-yd. 2-ply		.6063
Sateens, 53-inch 1.32-yd.		.57
58-inch 1.21-yd.		.6238

RAYON

TOTAL shipments of rayon by domestic producers during March amounted to 64,800,000, a decline of 17% from the February total. March filament yarn shipments reached 57,100,000 pounds, consisting of 40,200,000 pounds of viscose and cupra and 16,900,000 pounds of acetate. Rayon stocks on March 31 registered an increase to 48,400,000 pounds, which included 21,800,000 pounds of viscose and cupra yarn, 10,400,000 pounds of acetate yarn, and 16,200,000 pounds of staple.

Production of tire cord and fabric in 1948 totaled 556,000,000 pounds, a decline of 3% from the 1947 figure. Of the '48 total 249,000,000 pounds were of rayon and nylon fabric and cord, an increase of 8% over the 1947 figure. Cotton tire fabric, cord, and chafer bore the brunt of the decline, with production amounting to 307,000,000 pounds, a drop of 11% from the previous year. For the first time the usage of rayon and nylon fabric and cord exceeded the use of cotton in the tire industry. Rayon and nylon together accounted for 51% of the total tire fabric and cord market in 1948 (excluding chafer fabric), as compared with 46% in 1947 and about 4% in 1939.

Exports of viscose tire cord and yarn in 1948 totaled 4,855,000 pounds, a decline of 18% from the 1947 level. This drop was more than offset, however, by a 54% increase in exports of cord tire and fuel cell fabrics to 29,947,000 square yards. Canada was the major market for tire cord; while Mexico, Australia, Union of South Africa, United Kingdom, Argentina, and Canada, in that order, were the leading takers of rayon tire and fuel cell fabrics.

No changes in rayon tire yarn and fabric prices occurred during April.

Rayon Fabrics

Tire Yarns		
1100/480	$0.55	/ $0.57
1100/490	.57	
1150/490	.57	
1650/720	.54	/ .56
1650/980	.56	
1900/980	.56	
2200/960	.53	
2200/980	.55	
Tire Fabrics:		
1100/490/2	.71	
1650/980/2	.685	/ .70
2200/980/2	.67	

Compounding Ingredients Price Changes and Additions

Accelerators

Santocure	lb.	$0.55	/ $0.62
Thalam	lb.	.75	

Accelerator-Activators, Inorganic

Litharge, Eagle	lb.	.1775	/ .1785
Red lead, Eagle	lb.	.1875	
White lead, basis, Eagle	lb.	.17	/ .18

Accelerator-Activators, Organic

Emersol 110	lb.	.14	/ .15
120	lb.	.145	/ .155
130	lb.	.1675	/ .1775
210 Elaine	lb.	.1125	/ .135
Emery 600	lb.	.0875	/ .11
Hyfac 430	lb.	.165	/ .175
432	lb.	.18	/ .19

Antioxidants

Santowhite Crystals	lb.	1.65	/ 1.72
Sunolite	lb.	.23	/ .24

Colors—White

Cryptone ZS	lb.	.1225	/ .125

Zinc Oxides

Azo ZZZ-11, 44, -55	lb.	.135	/ .1375
-66	lb.	.1575	/ .16
35% leaded	lb.	.1425	/ .145
Eagle AAA, lead free	lb.	.135	/ .1375
A-5 5/8 leaded	lb.	.135	/ .1375
-35 5/8 leaded	lb.	.1425	/ .145
-50 5/8 leaded	lb.	.14 5/8	/ .14 7/8
Florence Green Seal-8	lb.	.1525	/ .155
Red Seal-9	lb.	.1475	/ .15
White Seal-7	lb.	.1575	/ .16
Horsehead XX-4, -78	lb.	.135	/ .1375
-505	lb.	.15	/ .1525
Kadox 15, 17, 72, 515	lb.	.135	/ .1375
-25	lb.	.1575	/ .16
Lehigh 35 5/8 Leaded	lb.	.1425	/ .145
50 5/8 leaded	lb.	.14 3/8	/ .14 7/8
Protox-166	lb.	.135	/ .1375
Standard, 5 5/8 leaded	lb.	.135	/ .1375

Carbon Blacks

SRF-Furnex	lb.	.0325	/ .075
Non-staining	lb.	.035	/ .0775
Sterling NS	lb.	.0375	/ .0775
HMF-Statex 93	lb.	.0475	/ .09
FF-Statex B	lb.	.055	/ .0975
FEF-Statex M	lb.	.0525	/ .095
VFF-Statex K	lb.	.07	/ .1125
Sterling 105	lb.	.12	/ .16

Dusting Agents

Glycerized Liquid Lubricant, concentrated	gal.	1.65	

Fillers, Inert

Cryptone BA, CB, MS	lb.	.0775	/ .08
Lithopone, Albalith	lb.	.0625	/ .065

Latex Compounding Ingredients

Aquablaks	lb.	.0775	/ .165
Pip-Pip	lb.	1.80	
R-2 Crystals	lb.	1.75	
Triton R-100	lb.	.14	/ .25

Mold Lubricants

Glycerized Liquid Lubricant, concentrated	gal.	1.65	

Plasticizers and Softeners

Emersol 110	lb.	.14	/ .15
120	lb.	.145	/ .155
130	lb.	.1675	/ .1775
210 Elaine	lb.	.1125	/ .135
Emery 600	lb.	.0875	/ .11
Flexol 3GH	lb.	.42	/ .44
3GO	lb.	.515	/ .535
4GO	lb.	.34	/ .38
8NS	lb.	.375	/ .395
DOP	lb.	.43	/ .455
RA	lb.	.47	/ .475
TOP	lb.	.47	/ .49
TWS	lb.	.405	/ .425
Hyfac 430	lb.	.165	/ .175
431	lb.	.18	/ .19
Monoplex DOA	lb.	.425	/ .445
Peptizene # 2	lb.	.90	
Picco 480 Oilproof resin	lb.	.13	
Rubberol Compound	lb.	.35	

Reinforcers, Other Than Carbon Black

Rubber Resin LM-4	lb.	.28	/ .35

Retarders

Retarder ASA	lb.	.45	

Tackifiers

Synthol	lb.	.32	

Vulcanizing Agents

Red lead, Eagle	lb.	.1875	
White lead silicate, Eagle	lb.	.185	/ .2025

VULCANIZED VEGETABLE OILS

—RUBBER SUBSTITUTES—

•

Types, grades and blends for every purpose, wherever Vulcanized Vegetable Oils can be used in production of Rubber Goods—be they Synthetic, Natural, or Reclaimed.

•

A LONG ESTABLISHED AND PROVEN PRODUCT

THE CARTER BELL MFG. CO.
SINCE
CARTER BELL PRODUCTS
1903
SPRINGFIELD, NEW JERSEY

Represented by:
HARWICK STANDARD CHEMICAL CO.
Akron — Boston — Trenton — Chicago — Denver — Los Angeles

Regular and Special Constructions of

COTTON FABRICS

Single Filling **Double Filling**
and

ARMY
Ducks

HOSE and BELTING
Ducks

Drills

Selected
Osnaburgs

Curran & Barry
320 BROADWAY
NEW YORK

United States Imports, Exports, and Reexports of Crude and Manufactured Rubber

Imports for Consumption of Crude and Manufactured Rubber

	January, 1949	
	Quantity	Value
UNMANUFACTURED, Lbs.		
Crude rubber	149,127,015	$27,037,698
Rubber latex	2,534,734	634,165
Balata	104,046	29,922
Jelutong or Pontianak	204,623	93,738
Gutta percha	42,305	11,934
Chicle	1,079,439	716,406
Synthetic rubber	2,076,627	384,722
Scrap rubber	926,834	28,400
TOTALS	156,095,603	$28,936,985
MANUFACTURED		
Tires: auto, bus, truck *no.*	1,757	$24,090
Bicycle *no.*	2,026	2,504
Other *no.*	25	194
Inner tubes, auto, etc *no.*	615	1,339
Rubber footwear:		
Boots *prs.*	18,000	33,545
Shoes and overshoes *prs.*	24,375	25,464
Rubber-soled canvas shoes *prs.*	603	2,488
Balls, except golf and tennis *no.*	262,177	22,007
Toys, except balloons		8,021
Hard rubber goods:		
Combs *no.*	144	31
Other		1,574
Rubberized printing blankets *lbs.*	40	61
Rubber and cotton packing *lbs.*	793	1,044
Gaskets and valve packing		200
Belting *lbs.*	3,982	5,753
Hose and tubing		12
Nipples and pacifiers *gross*	93	174
Gutta percha manufactures *lbs.*	392	315
Rubber bands *lbs.*	2,403	1,280
Synthetic rubber products		218
Soft rubber products		15,999
TOTALS		$146,313
GRAND TOTALS, ALL RUBBER IMPORTS		$29,083,298

Reexports of Foreign Merchandise

UNMANUFACTURED, Lbs.		
Crude rubber	1,695,007	$320,036
Balata	11,959	3,923
TOTALS	1,706,966	$323,959
MANUFACTURED		
Drug sundries, except syringes and hot water bottles		$973
Rubber and rubberized clothing		1,701
Toys and balls, except balloons		420
Erasers *lbs.*	1,466	371
Tire casings: truck and bus *no.*	3	300
Farm tractor, etc *no.*	181	2,083
Hose and tubing *lbs.*	251	366
Rubber packing *lbs.*	2,063	1,354
Other natural and synthetic rubber products		1,216
TOTALS		$8,784
GRAND TOTALS, ALL RUBBER REEXPORTS		$332,743

Exports of Domestic Merchandise

UNMANUFACTURED, Lbs.		
Chicle	190,782	$101,770
Balata	300	945
Synthetic rubber: GR-S	729,714	154,953
Neoprene	479,970	164,321
Nitrile	184,773	80,000
Polyisobutylene	9,423	3,047
Other, except Butyl and "Thiokol"	12,558	13,951
Reclaimed rubber	2,219,199	171,178
Scrap rubber	7,067,897	249,012
TOTALS	10,894,616	$939,177
MANUFACTURED		
Rubber cement *gals.*	39,848	$55,600
Rubberized fabric: auto cloth *sq. yds.*	77,883	78,630
Piece goods and hospital sheeting *sq. yds.*	63,243	41,355
Rubber footwear:		
Boots *prs.*	18,693	85,636
Shoes and overshoes *prs.*	5,686	12,433
Rubber-soled canvas shoes *prs.*	55,041	132,969
Soles *doz. prs.*	24,409	76,106
Heels *doz. prs.*	61,239	60,408
Rubber soling and topliff sheets *lbs.*	109,446	25,749
Gloves and mittens *doz. prs.*	16,161	56,712
Drug sundries: water bottles and fountain syringes *no.*	37,762	21,546
Other		184,710
Rubber and rubberized clothing		85,230
Balloons		46,281
Toys and balls		20,498
Erasers *lbs.*	21,391	16,601
Hard rubber goods: battery boxes *no.*	55,152	66,573
Other electrical goods *lbs.*	127,512	73,392
Combs, finished *doz.*	8,295	5,727
Other		24,456
Tire casings: truck and bus *no.*	106,698	1,528,972
Auto *no.*	71,823	1,007,329
Tires and casings: aircraft *no.*	2,818	149,808
Casings: tractor, etc *no.*	6,086	224,222
Other off-the-road types *no.*	4,179	203,932
Tires and casings:		
Bicycle *no.*	9,275	15,498
Motorcycle *no.*	705	3,228
Other *no.*	2,799	78,033
Inner tubes: auto, truck, bus *no.*	130,117	419,914
Other *no.*	17,169	58,794
Solid tires: truck and industrial *no.*	4,628	187,057
Other *lbs.*	7,170	2,127
Tire repair materials: camelback *lbs.*	378,518	110,784
Other *lbs.*	263,502	152,548
Rubber and friction tape, non-medical *lbs.*	41,758	27,229
Belting: auto and home *lbs.*	126,787	130,897
Transmission:		
V-belts *lbs.*	130,502	190,041
Flat belts *lbs.*	37,470	48,613
Other *lbs.*	40,581	61,548
Conveyer and levitator *lbs.*	142,510	112,903
Other *lbs.*	170,261	125,725
Hose and tubing *lbs.*	742,745	569,614
Rubber packing *lbs.*	125,959	122,375
Mats, flooring, tiling *lbs.*	770,944	213,164
Rubber thread: bare *lbs.*	30,901	40,608
Textile covered *lbs.*	6,470	16,136
Gutta percha manufactures *lbs.*	1,245	3,150
Latex and other compounded rubber for further manufacture *lbs.*	257,924	117,947
Other natural and synthetic rubber products		353,216
TOTALS		$10,446,024
GRAND TOTALS, ALL RUBBER EXPORTS		$11,285,201

SOURCE: Bureau of Census, United States Department of Commerce, Washington, D. C.

Rims Approved and Branded by The Tire & Rim Association, Inc.

RIM SIZE	Mar., 1949
15" & 16" D. C. Passenger	
15x3.50D	7,613
16x4.00E	298,653
16x4.50E	166,381
15x5.00E	52,660
16x5.00F	26,989
15x5.50F	29,800
16x5.50F	7,183
16x6.00F	2,632
16x4.00E—Hump	19,547
16x4.50E—Hump	14,444
15x4½-K	65,456
16x4½-K	125,837
15x5-K	424,518
15x5½-K	333,364
16x5½-K	650
15x6-L	118,220
16x6-L	7,863
15x6½-L	172,278
16x6½-L	342
15x4½-K—Hump	271,767
15x5-K—Hump	29,324
15x5½-K—Hump	82,550
15x6-L—Hump	18,930
Truck-Bus	
20x4.33R	3,669
17x5.0	29,755
18x5.0	17,965
20x5.0	33,197
15x5.00S	367
20x5.00S	22,548
17x5.5	18,000
15x5.50S	2,913
17x6.0	1,430
20x6.0	80,059
20x6.00S	83,334
20x6.00T	9,259
24x6.00T	90
20x6.5	1,390
20x6.50T	30,369
22x6.50T	577
24x6.50T	802
18x7.0	661
20x7.0	1,060
20x7.33V	8,526
22x7.33V	1,999
20x7.5	7,065
24x7.5	1,990
20x7.50V—Flat Base	9,869
22x7.50V—Flat Base	252
20x8.00V	11,721
22x8.00V	2,749
20x8.37V	137
24x8.37V	689
20x10.0	800
Semi D. C. Truck	
16x4.50E	11,460
15x5.50F	47,646
16x5.50F	58,135
16x6.50H	9,884
Tractor & Implement	
12x2.50C	22,122
12x3.00D	42,191
15x3.00D	26,249
16x3.00D	8,129
18x3.00D	814
19x3.00D	24,429
21x3.00D	4,432
36x3.00D	17,027
18x3.62F	542
20x4.50E	10,317
36x4.50E	855
16x4.75KA	488
12x5.00JA	2,525
18x5.50F	18,979
20x5.50F	5,136
20x8.00T	653
24x8.00T	1,095
24x8.00T-S.D.C.	1,071
28x8.00T	2,180
W5-30	1,939
W6-24	2,199
W7-24	4,262
W8-24	6,068
W8H-24	3,680
W8-36	6,986
W9-24	6,956
W9-28	28,329
W9-36	3,921
W9-38	4,051
W10-24	2,100
W10H-24	907
W10-28	7,924
W10-38	7,057
W11-26	1,850
W11-28	1,110
W11-38	679
W12-38	1,960
DW9-38	3,589
DW10-38	6,718
DW11-24	538
DW11-28	1,251
DW11-38	8,699
DW12-26	1,731
DW12-30	2,916
DW12-34	1,814
DW14-26	8
DW14-30	1,079
DW14-34	356
DW16-26	293
Earth Mover	
20x11.25	250
24x11.25	142
24x13.00	118
24x15.00	104
25x17.00	25
29x17.00	118
TOTAL	3,104,539

Trade Marks

(Continued from page 238)

corsets, brassieres, Swisstex Co., West New York, N. J.

442,349. Representation of an Indian's head below the words: **"Red Skin."** Suspenders, garters, and arm-bands. Reiter Bros., New York, N. Y.

442,353. **Gatex.** Auto floor mats and sheeting. Gates Rubber Co., Denver, Colo.

507,127. **April.** Shower curtains. W. W. Loeb Co., Los Angeles, Calif., assignee of W. W. Loeb Co., a corporation of Calif.

507,136. **Stadium Boot.** Footwear. Consolidated Footwear Corp., New York, N. Y.

507,168. **Bay State.** Grinding, abrading, polishing wheels, etc. Bay State Abrasive Products Co., Westboro, Mass.

Estimated Automotive Pneumatic Casings and Tube Shipments, Production, Inventory—February, January, 1949; First Two Months, 1949-1948

	1949				1948,
		% of Change from Preceding		First Two	First Two
Passenger Casings	February	Month	January	Months	Months
Shipments					
Original equipment	1,819,103		1,905,612	3,724,715	3,442,805
Replacement	2,086,124		2,301,919	4,388,043	5,158,058
Export	31,263		41,505	702,768	155,792
Total	3,936,490	− 7.36	4,249,036	8,185,526	8,756,655
Production	4,782,570	− 0.22	4,772,116	9,554,686	11,555,834
Inventory end of month	10,180,057	− 9.24	9,319,292	10,180,057	8,231,088
Truck and Bus Casings					
Shipments					
Original equipment	352,696		398,353	751,049	906,054
Replacement	502,375		552,863	1,055,238	1,167,057
Export	73,908		85,151	159,059	197,260
Total	928,979	−10.36	1,036,367	1,965,346	2,270,371
Production	1,108,262	− 1.39	1,123,820	2,232,082	2,683,040
Inventory end of month	2,205,302	+ 9.17	2,020,154	2,205,302	1,940,861
Total Automotive Casings					
Shipments					
Original equipment	2,171,799		2,303,965	4,475,764	4,348,859
Replacement	2,588,499		2,854,782	5,443,281	6,325,115
Export	105,171		126,656	231,827	353,052
Total	4,865,469	− 7.95	5,285,403	10,150,872	11,027,026
Production	5,890,832	− 0.09	5,895,936	11,786,768	14,238,874
Inventory end of month	12,385,359	+ 9.22	11,339,446	12,385,359	10,171,949
Passenger and Truck and Bus Tubes					
Shipments					
Original equipment	2,168,011		2,297,823	4,465,834	4,344,663
Replacement	2,160,037		2,531,067	4,691,104	4,933,751
Export	75,958		96,657	172,615	186,575
Total	4,404,006	−10.59	4,925,547	9,329,553	9,464,989
Production	4,921,766	− 2.78	5,062,357	9,984,123	11,194,500
Inventory end of month	10,442,118	+ 6.39	9,814,837	10,442,118	9,656,977

NOTE: Cumulative data on this report include adjustments made in prior months.
SOURCE: The Rubber Manufacturers' Association, Inc., New York, N. Y.

United States Rubber Statistics—January, 1949

(All Figures in Long Tons, Dry Weight)

	New Supply			Distribution		Month-End
	Production	Imports	Total	Consumption	Exports	Stocks
Natural rubber, total	0	65,576	65,574	47,662	757	115,023
Latex, total	0	1,132	1,132	2,526	0	10,027
Natural rubber and latex, total	0	67,706	67,706	50,188	757	125,050
Synthetic rubber, total	*35,236	927	39,817	36,765	623	118,364
	†3,654					
GR-S	*30,163	813	31,299	28,619	326	299,488
	†255					
Neoprene	†2,516	0	2,516	2,939	214	4,569
Butyl	*5,073	114	5,187	4,698	0	11,581
Nitrile	†885	0	885	518	83	2,726
Natural rubber and latex, and synthetic rubber, total	38,890	68,633	107,523	86,953	1,380	243,414
Reclaimed rubber, total	19,741	0	19,741	19,031	991	32,868
GRAND TOTALS	58,631	68,633	127,264	105,984	2,371	276,282

*Government plant production.
†Private plant production.
‡Includes seven tons shipped for export, but not cleared.
SOURCE: Rubber Division, ODC, United States Department of Commerce, Washington, D. C.

Dividends Declared

COMPANY	STOCK	RATE	PAYABLE	STOCK OF RECORD
Anaconda Wire & Cable Co.	Com.	$0.50	Apr. 19	Apr. 8
Armstrong Rubber Co.	"A & B"	0.25	Apr. 1	Mar. 25
	Pfd.	0.59⅜ q.	Apr. 1	Mar. 22
Baldwin Rubber Co.	Com.	0.10 extra	Apr. 27	Apr. 15
	Com.	0.15 q.	Apr. 27	Apr. 15
Boston Woven Hose & Rubber Co.	Com.	0.50 q.	May 25	May 13
	Pfd.	3.00 s.	June 15	June 1
Crown Cork & Seal Co., Inc.	Com.	0.25	May 20	Apr. 12
DeVilbiss Co.	Com.	0.12½ irreg.	Apr. 20	Apr. 8
Electric Hose & Rubber Co.	Com.	0.30 q.	May 20	May 13
Firestone Tire & Rubber Co.	Pfd.	1.12½ q.	June 1	May 14
Goodall Rubber Co.	Com.	0.15	May 14	May 2
	5% Pfd.	2.50	May 14	May 2
	Com.	0.15 q.	May 14	May 2
Goodyear Tire & Rubber Co.	Com.	1.00 q.	June 15	May 16
	Pfd.	1.25 q.	June 2	May 16
Goodyear Tire & Rubber Co. of Canada, Ltd.	Pfd.	0.50 q.	Apr. 30	Mar. 8
Gro-Cord Rubber Co.	Com.	0.10	Mar. 31	Mar. 18
Byron Jackson Co.	Com.	0.50 q.	May 16	Apr. 30
Johnson & Johnson	Pfd.	1.00 q.	May 2	Apr. 15
	Pfd. "B"	0.87½ q.	May 2	May 2
Lee Rubber & Tire Corp.	Com.	0.50 q.	May 2	Apr. 15
Link Belt Co.	Com.	1.00 q.	June 1	May 4
Midwest Rubber Reclaiming Co.	Com.	0.25 q.	May 1	Apr. 16
Thermoid Co.	Pfd.	0.62½ q.	May 2	Apr. 21
Union Asbestos & Rubber Co.	Com.	0.25	July 2	June 10
S. S. White Dental Mfg. Co.	Com.	0.37½ q.	May 14	Apr. 29
Whitehead Bros. Rubber Co.	Com.	0.15	May 14	May 2

FINANCIAL

Anaconda Wire & Cable Co., New York, N. Y. For 1948: net income, $7,009,136, equal to $8.30 a share, compared with $8,480,513, or $10.05 a share, in 1947; net sales, $106,673,119.

Borg-Warner Corp., Chicago, Ill., initial quarter, 1949: net income, $6,692,393, equal to $2.79 each on 2,330,741 common shares, against $6,702,202, or $2.82 a share, a year earlier; sales, $78,766,039, against $77,100,726.

Collyer Insulated Wire Co., Inc., Pawtucket, R. I. For 1948: net income, $254,179, equal to $1.69 a share, against $270,682, or $1.80 a share, in 1947.

Dow Chemical Co., Midland, Mich., and subsidiaries. Nine months ended February 28: net profit, $21,393,730, equal to $3.81 each on 5,124,274 common shares, against $14,025,192, or $2.47 each on 4,994,824 shares, in the corresponding period a year ago; reserve for income taxes, $13,580,257, against $8,810,348.

Eagle-Picher Co., Cincinnati, O., and subsidiaries. Quarter ended February 28, 1949: net profit, $1,551,388, equal to $1.74 each on 889,076 common shares, against $651,918, or 73¢ a share, a year earlier; sales, $19,543,211, against $17,664,740.

General Electric Co., Schenectady, N. Y., and affiliates. First quarter, 1949: net profit, $26,702,978, equal to 93¢ a common share, against $25,389,149, or 88¢ a share, in the 1948 months; consolidated net sales, $411,615,528, against $365,957,990; provision for federal taxes, $23,500,000, against $21,500,000.

Goodyear Tire & Rubber Co of Canada, Ltd., New Toronto, Ont. For 1948: net income, $2,412,119, equal to $8.14 a common share, contrasted with $3,931,248, or $14.23 a share, a year earlier; reserve for depreciation, $1,385,935, against $816,667; income taxes, $1,536,145, against, $3,358,240; current assets, $14,452,548, current liabilities, $3,841,943; inventories, $10,619,131, against $9,902,185.

Monsanto Chemical Co., St. Louis, Mo. First quarter, 1949: net earnings, $4,461,608, equal to 97¢ each on 4,274,965 common shares, contrasted with $3,805,588, or 85¢ each on 4,250,453 shares, in the corresponding period of 1948; sales, $40,893,943, against $38,473,744.

Pittsburgh Plate Glass Co., Pittsburgh, Pa. Quarter ended March 31; net income, $7,831,756, equal to 87¢ a share, against $6,667,895, or 75¢ a share, in the '48 quarter; sales, $70,735,310, against $66,731,935.

Union Carbide & Carbon Corp., New York, N. Y., and subsidiaries. March quarter: consolidated net income, $24,529,419, equal to 85¢ each on 28,807,314 shares, against $23,019,722, or 80¢ a share, a year earlier; gross sales, $157,037,519, against $150,154,423; income taxes, $15,289,542, against $15,412,655.

OBITUARY

Clifton Slusser

Clifton Slusser

CLIFTON SLUSSER, who rose from stenographer to vice president and factory manager of The Goodyear Tire & Rubber Co., Akron, O., and who was one of the nation's outstanding production experts, died in an Akron hospital on March 25. He had relinquished many of his production duties and his position on the Goodyear board of directors two years ago because of ill health.

Mr. Slusser had been with the company since August, 1911, when he was hired as a clerk in the office of Paul W. Litchfield, then company superintendent. A few years later Mr. Slusser became a factory stenographer and soon after that was made organizer of the company's Flying Squadron, a training organization. Later he became manager of efficiency, planning, interplant relations, and the factory personnel departments and in 1919 became a member of the executive council of five. In 1920 the deceased was named superintendent in charge of production of the new Los Angeles, Calif., plant. Two years later he returned to Akron as factory staff manager and remained in that position until 1926 when he was elevated to a vice presidency. In 1932 he was elected a director.

Under Mr. Slusser's direction new factories were established at Gadsden, Ala.; Wolverhampton, England; Buenos Aires, Argentina; Jackson, Mich.; St. Marys, O.; Buitenzorg, Java; Windsor, Vt.; Sao Paulo, Brazil; Norrkoping, Sweden; Lecheria, Mexico; Lima, Peru; Lincoln, Neb.; Topeka, Kan.; Havana, Cuba; Niagara Falls, N. Y.; and textile mills were built at Cedartown, Rockmart, and Cartersville, all in Ga., and Decatur, Ala.

The deceased was born in Massillon, O., May 28, 1890. He left school when he was 11 and worked at glass-blowing, helped in a machine factory, and assisted a plumber before becoming associated with the rubber industry. After joining Goodyear he resumed his education at night.

A member of the Masonic bodies, Mr. Slusser was also a 32nd degree Mason and a member of the Portage Country Club.

Funeral services were held March 28 at the Church of Our Saviour, Akron, followed by burial at Rose Hill Burial Park.

Surviving are the widow, a son, and a sister.

William B. Dunsford

THE president and treasurer of Lowell Insulated Wire Co., Lowell, Mass., William Bevan Dunsford, died of a heart attack April 3. Funeral services were from his home in Chelmsford, Mass., on April 5, followed by burial in that city.

Mr. Dunsford was born in Lowell on August 10, 1904. He was graduated from Phillips-Andover Academy in 1923 and Cambridge University with a B.A. degree in 1927. In 1928 and 1929 he was associated with Hornblower & Weeks. He began his career in the rubber industry when he joined Lowell Insulated Wire in 1930.

A trustee of the Central Savings Bank, he was also a director of the Lowell Community Chest, and a member of the Lowell Humane Society, Old Scouts, and Lowell Boys', Literary, Yorick, Vesper Country, and the Algonquin clubs.

Surviving the deceased are the widow, a daughter, a son, a sister, and three brothers.

Willard H. Dow

WILLARD HENRY DOW, president of Dow Chemical Co., Midland, Mich., and his wife crashed to their deaths in a plane accident near London, Ont., Canada, on March 31. He had been chief executive of the company since 1930, following the death of his father, founder of the concern.

Dr. Dow was born in Midland, January 4, 1897, and attended local grammar and high schools. He was graduated from the University of Michigan in 1919 with a B.S. in Chemical Engineering. In 1939 he received an honorary doctorate in science from the Michigan College of Mining & Technology and an honary doctorate in engineering in 1941 from the University of Michigan and in 1944 from Illinois Institute of Technology.

He joined Dow in 1919, became a director in 1922, assistant general manager in 1926, president and general manager in 1930, and chairman of the board in 1941. He was also a director of the Midland Ammonia Co., Dowell, Inc., Dow Magnesium Corp., Dow Chemical of Canada, Ltd., Dow Corning Corp., and The Saran Yarns Co.

Dr. Dow received the Medal Award of the Advancement of Research by the American Society for Metals and was chosen one of America's 50 foremost business leaders by *Forbes Magazine* in 1948, received the Chemical Industry Medal by the American Section of the Society of the Chemical Industry in 1946, the Gold Medal of the American Institute of Chemists in 1944, and the Chandler Medal of Columbia University in 1943.

Dr. Dow was a 33rd degree Mason and a Shriner; a member of the Chemical Advisory Committee, National Military Establishment Munitions Board, Chemical Corps Advisory Board, American Institute of Chemical Engineers, AIC, SCI, American Association for Advancement of Science, American Chemical Society, the board of control of Michigan College of Mining & Technology, Theta Delta Chi, Alpha Chi Sigma, Tau Beta Pi, the Detroit, Chemists (N. Y.), Bohemian, Midland Country, Crystal Downs Country, Rockefeller Center, and York clubs, and the Newcomen Society; a director-at-large of Chemical Corps, Association; and an adviser to Resources Division, Office of the Quartermaster General.

Willard H. Dow

Surviving the deceased are his mother, a son, a daughter, a brother, three sisters, and two grandchildren.

Private funeral services for Dr. and Mrs. Dow were held April 4 at St. John's Episcopal Church, Midland, followed by interment in Midland Cemetery.

Raymond N. McAdams

RETIRED since March, 1948, Raymond N. McAdams, former secretary of Hercules Powder Co., Wilmington, Del., died of a heart ailment April 9 at a Delaware hospital. Funeral services for the 65-year-old executive were held April 13 from the Yeatman Funeral Home, Wilmington.

Mr. McAdams was born and educated in Indianapolis, Ind. After five years in the Navy he came to Wilmington in 1906 and worked for E. I. du Pont de Nemours & Co., Inc. Then in 1910 he went to Taltal, Chile, as office manager for DuPont Nitrate Co. and remained there until 1912. The following year he joined Hercules at the time of its organization and served as chief clerk of the works accounting division. In 1926 he was named assistant treasurer of the company and in 1941 secretary.

Mr. Adams was a former trustee of the West Presbyterian Church, a member of the Wilmington and Hercules country clubs, and past president of the Hercules Men's and the Quarter Century clubs.

He leaves his wife, a daughter, a brother, and two grandsons.

Trade Lists Available

The Commercial Intelligence Branch, United States Department of Commerce, Washington, D. C., recently compiled the following trade lists, of which mimeographed copies may be obtained by American firms from this Branch and from Department of Commerce field offices at $1 a list for each country.

Aircraft & Aeronautical Equipment Importers & Dealers—Belgian Congo; Iran.

Aircraft & Aeronautical Supply & Equipment Importers and Dealers—Brazil; Portugal; Spain.

Aircraft & Aeronautical Supply Importers & Dealers—Iraq.

Boot & Shoe Manufacturers—Spain.

Rubber Goods Manufacturers—Siam.

Rubber Stamp & Stencil (Mimeograph) Manufacturers—Canada; Israel.

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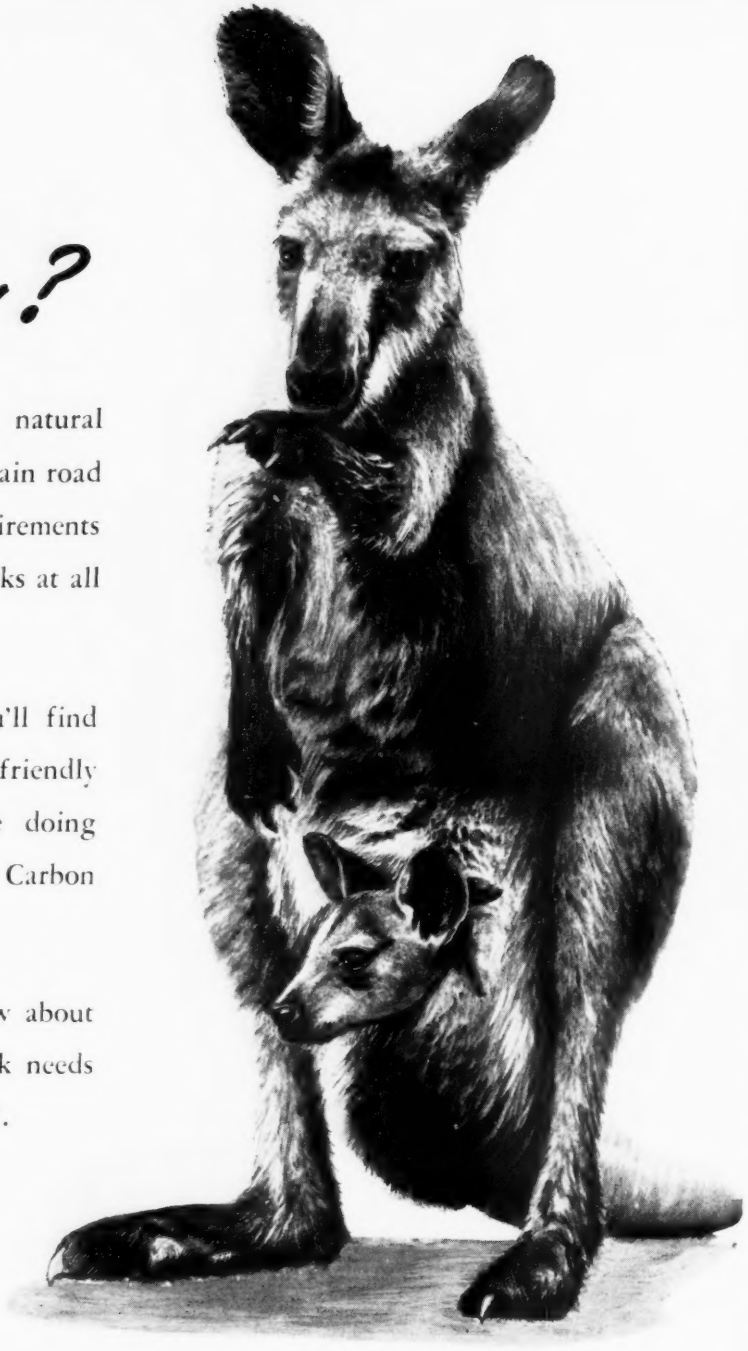

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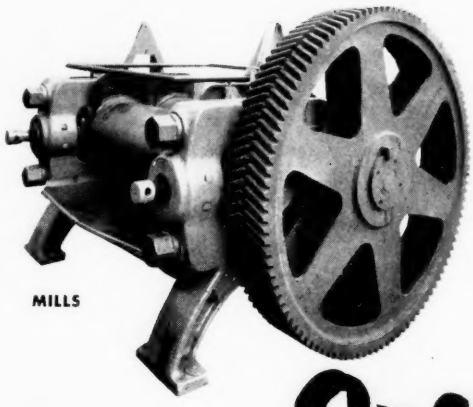

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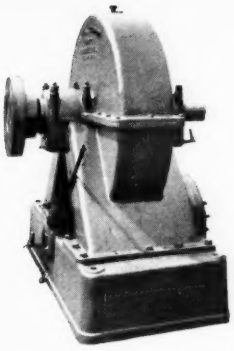

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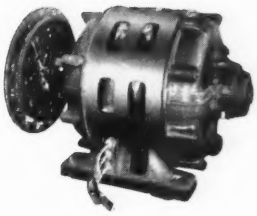

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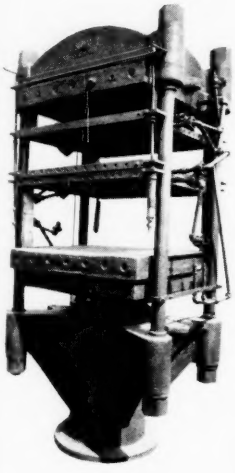

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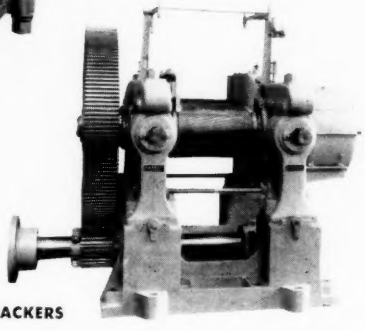

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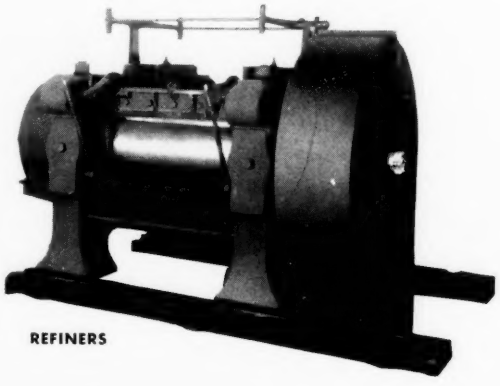

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